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RESULTS OF DUST OBSCURATION TESTS (DOT) USING EXPLOSIVES FORT CARSON, COLORADO

by

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The US Army Engineer Waterways Experiment Station (WES) conducted dust obscuration measurements at Fort Carson, Colo., in April and August 1983 to demonstrate the validity of existing models to predict crater volumes produced by a given explosive charge and to use models developed by the Atmospheric Sciences Laboratory (ASL) to predict the mass of dust in clouds formed from the explosions. It was found that apparent craters formed agreed well with the "1.111 Power Law" used in

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20. ABSTRACT (Continued).

EOSAEL 82 (COMBIC) developed by ASL. Cloud masses were calculated using techniques developed by ASL and a contractor, PEDCo, Inc. (now PEI Associates). Generally, results obtained at Fort Carson showed that from 2 to 5 percent of the excavated soil mass would be found in a dust cloud after approximately 10 sec had elapsed from detonation.

Improvements in sampling techniques, particularly those characterizing the vertical nature of the cloud, are recommended. Since the composition of the cloud can vary greatly in a few metres of downwind distance, different sampler types should be used and should be positioned as close together as practical to determine differences in the respective samplers.

Other recommendations concerning the conduct of future tests are included.

PREFACE

The work reported herein was conducted by the US Army Engineer Waterways Experiment Station (WES), Environmental Laboratory (EL), for the Office, Chief of Engineers (OCE), US Army, under DA Project No. 4A762730AT42, Task Area B/E5, Work Unit 002. Dr. C.A. Meyer and MAJ Denton Brown, DAEN-ZCM, were the OCE Technical Monitors. This research was conducted under the AirLand Battlefield Environment Thrust. The purpose was to identify factors in the environment influencing the amount of dust lofted from explosive bursts of various sizes. These studies were conducted in April and August 1983 at Fort Carson, Colo.

In the April 1983 exercise, US Army Atmospheric Sciences Laboratory personnel performed the tasks of test layout and meteorological and dust data collection; WES personnel provided crater and soil characterization and photographic coverage. In the August 1983 exercise, a WES contractor, PEDCo Environmental, Inc., devised and executed the dust sampling program.

Mr. James B. Mason of the Environmental Analysis Group (EAG), Environmental Systems Division (ESD), EL, directed the April exercise; Mr. Randall R. Williams, EAG, directed the August exercise. The report was prepared by Ms. Katherine S. Long and Mr. Williams, EAG, and by Dr. Roger E. Davis, Science and Technology Corporation (STC), Las Cruces, NM (Contract No. DACA39-85-C-0006) under the direct supervision of Mr. Harold W. West, Chief, EAG, and under the general supervision of Dr. L.E. Link, Jr., Chief, ESD, and Dr. John Harrison, Chief, EL. STC personnel performed data analysis and prepared a major portion of the report as well as the computer graphics presented in the text and in Appendixes A and B. The report was edited by Ms. Jessica S. Ruff of the WES Publications and Graphic Arts Division (PGAD). Layout of the appendixes was accomplished by Ms. Beatrice W. Watson, PGAD.

At the time of publication, COL Allen F. Grum, USA, was Director of WES and Dr. Robert W. Whalin was Technical Director.

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CONTENTS

RESULTS OF DUST OBSCURATION TESTS (DOT) USING EXPLOSIVES, FORT CARSON, COLORADO

PART I: INTRODUCTION

Background

1. The US Army Engineer Waterways Experiment Station (WES) is conducting research related to the determination of the terrain dust concentration and composition for realistic battlefield conditions. This research is sponsored by the Office, Chief of Engineers, US Army, under the auspices of the Battlefield Terrain Working Group of the AirLand Battlefield Environment Thrust (Deepak 1983). The importance of terrain dust has increased as a result of the development of high-technology weapons, sensors, and surveillance systems. The potential effects of terrain dust upon battlefield operations and equipment are significant, and dust properties and characteristics vary greatly with geographic location, climate, season, and even time of day. The prediction of dust concentrations and composition in a region being used for a military activity is an integral part of combat survivability. WES's primary thrust has been to determine the terrain and environmental factors affecting dust generation and transmission and to develop analytical relations that describe those dependencies. This research will provide data to analysts involved in combat effectiveness studies and to military engineer teams involved in predicting the performance of weapon systems in combat.

2. An experimental research program is being conducted jointly by WES and the US Army Atmospheric Sciences Laboratory (ASL) to determine data and relationships for use in an analytical procedure for prediction of terrain dust generated by explosions such as impacting munitions, moving vehicles, weapon firings, and helicopter landings and takeoffs. The principal goal of the explosive tests has been to develop a database to correlate soil properties with airborne dust loading. The initial series of tests in the Corps of Engineers' dust research program focused on determining the correlations with dust loading by considering the sand, silt, and clay content of soils before explosive detonation. This test series was designated the Battlefield Environments from Tailored Soils (BETS) (Mason and Long 1981; Kennedy 1982; Mason and Long 1983). The objective of BETS was to account for the material removed from craters produced by uncased simulated munition rounds to infer the dust cloud mass and distribution.

3. The second series of experimental explosive tests, conducted at Fort Carson, Colo., in April and August 1983, were designated the terrain Dust Obscuration Tests (DOT). The April test (DOT I) was conducted jointly by the ASL, White Sands Missile Range, N. Mex., and WES (Long et al. 1985). The August test (DOT II) was conducted by the WES with some field support provided by a WES contractor (PEDCo Environmental, Inc.).

Objective

4. The objective of the DOT was to gather meaningful data concerning the amount and characteristics of the obscurants released into the atmosphere by two likely components of the battlefield environment: (a) explosive activity and (b) vehicular traffic. The explosive trials were conducted by placing uncased C-4 charges upwind of the sampling array. The vehicular trials were conducted by running tracked and wheeled military vehicles upwind of the sampling array. This report documents the results of the DOT explosive tests.

Scope

5. Part II of this report describes physical features of the test sites selected. The instruments used to measure the phenomena resulting from the blasts are also described, and the conduct of the explosive events is summarized.

6. Part III describes the kinds of data collected during the high-explosive trials. Basic soil characteristics were measured before and after each event. The data collected for the DOT I events were greater than those in DOT II in both number and kind. These data were meteorological data, transmission data, and dust collection data gathered at the time of each event and shortly thereafter until it was determined that measurable effects of the blast had vanished. In the DOT II phase, limited meteorological and soil data were taken in addition to dust collection. After each event, the physical measurements of the resulting crater were taken.

7. Part IV presents the analysis of crater geometries and resulting clouds. Part V presents the conclusions and recommendations for future studies.

PART II: DESCRIPTION OF TESTS

Test Sites

8. The two test sites used for the Fort Carson DOTs are respectively located 2 km north of the southernmost gate of the Military Reservation (DOT I) and approximately 2 km southeast of Camp Red Devil (DOT II), as shown in Figures 1 and 2. The sites are gently sloping, with the Rocky Mountains approximately 60 km to the northwest and open terrain and low hills to the east and south. The Fort Carson reservation can be considered analogous to many semiarid regions of the world in terms of surface soil types and vegetation ground cover types. Figure 2 shows the portions of the reservation that are covered by the predominant short- and mixed-grass prairie species that occur at the two test sites. Figures 3 and 4 are presented as pictorial records of the terrain and ground cover found at the DOT I and II sites, respectively.

9. The surface soil at Site 1 (DOT I) was a light brown sandy clay material classified according to the Unified Soil Classification System (USCS) as a sandy clay (CL). The in situ moisture content of the surface soil ranged between 6.7 and 26.7 percent, with the maximum moisture occurring just after the site received some light rainfall. Soil strength or cone index (CI) was 50 at the surface and increased to approximately 200 at a 15-cm depth and 750+ at a 30-cm depth. The surface soil at Site 2 (DOT II) was a reddish-brown, sandy clay-sandy silt material classified as CL according to the USCS. The moisture content ranged from 7.2 to 17.5 at the surface, and the soil strength varied from 100 CI in the surface layer to 750+ CI at the depth of 15-30 cm. Figure 5 shows the surface soil grain sizes at the two test sites.

10. The predominant vegetation types occurring at the sites were short grasses and plants of blue grama, Russian thistle, lamb's-quarters, and prickly pear. Height of the plants ranged 10-20 cm, and the ground area of coverage was 50-70 percent, as illustrated in Figures 3 and 4. Figure 6 displays typical root depths (approximately 15-20 cm) for the grass clumps growing at the sites.

11. Site 1 near the southern boundary normally receives approximately 9-11 in. (23-28 cm) average annual rainfall. Site 2, near Camp Red Devil, receives an average of 12-13 in. (30-33 cm) of rainfall annually. Some rainfall did occur during both the April and August tests, which is reflected in the in situ moisture data presented.

Instrumentation

12. The instrumentation for the April explosive tests was provided by the ASL and consisted of a multiwavelength transmissometer, eight Hi-Vol dust samplers (height 1.5 m, spaced 6-10 m apart), five nephelometers, a Knollenberg counter, a spectrophone, four Gelman vertical samplers (heights 2, 6, 11, 15 m), and 2- and 16-m meteorological towers containing sensors for measurements of wind speed, wind direction, air temperature, dew point, humidity, and solar radiation. Additional meteorological sensors were included on the 16-m tower at heights of 4 m and 8 m. Meteorological sensor measurements were digitally recorded at 2-sec intervals. Figure 7a shows the layout and general ground-level view of the instrumentation. Further description of the instrumentation and calibration procedures is provided in a preliminary project report by Hoock and Kennedy (1983).

13. For the August tests, the instrumentation (Figure 7b) consisted of five Hi-Vol dust samplers (spaced 20 m apart and 2.5 m above ground), two tethered balloons each with four 47-mm polyvinyl chloride vertical samplers located at heights of 1.5, 7.6, 15.2, and 22.9 m above the ground,

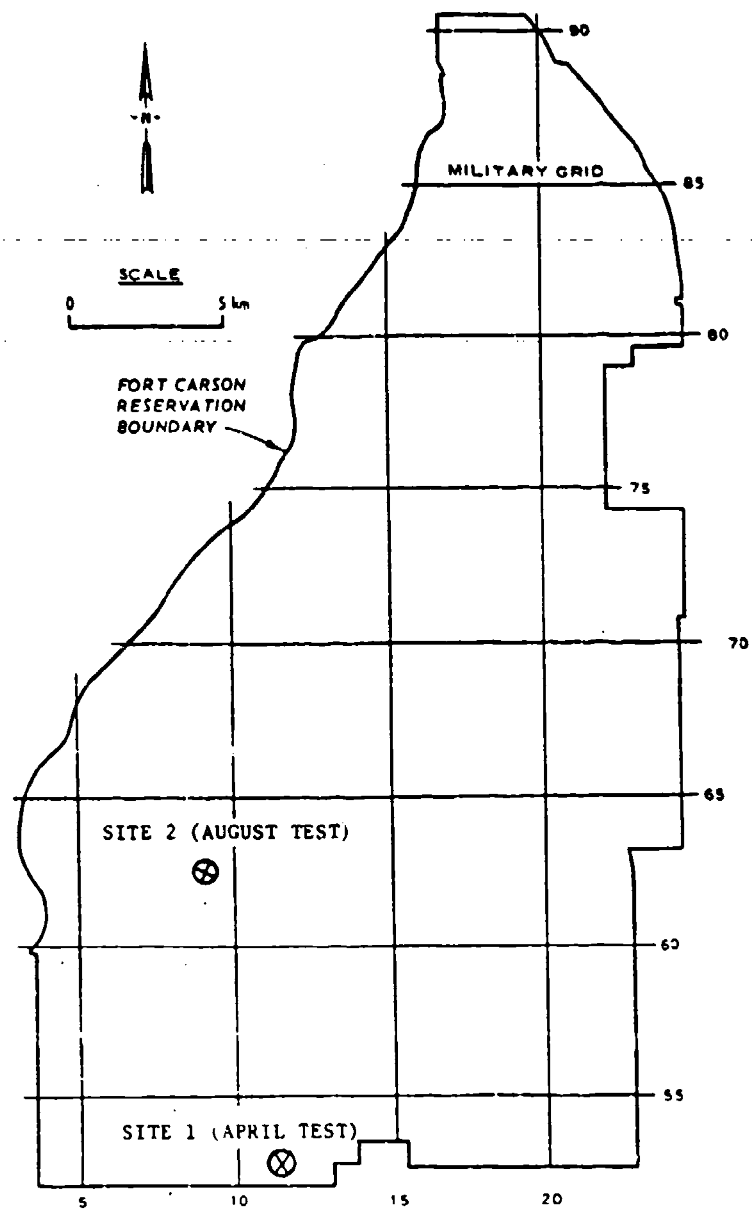


Figure 1. Location of test sites at Fort Carson, Colo.

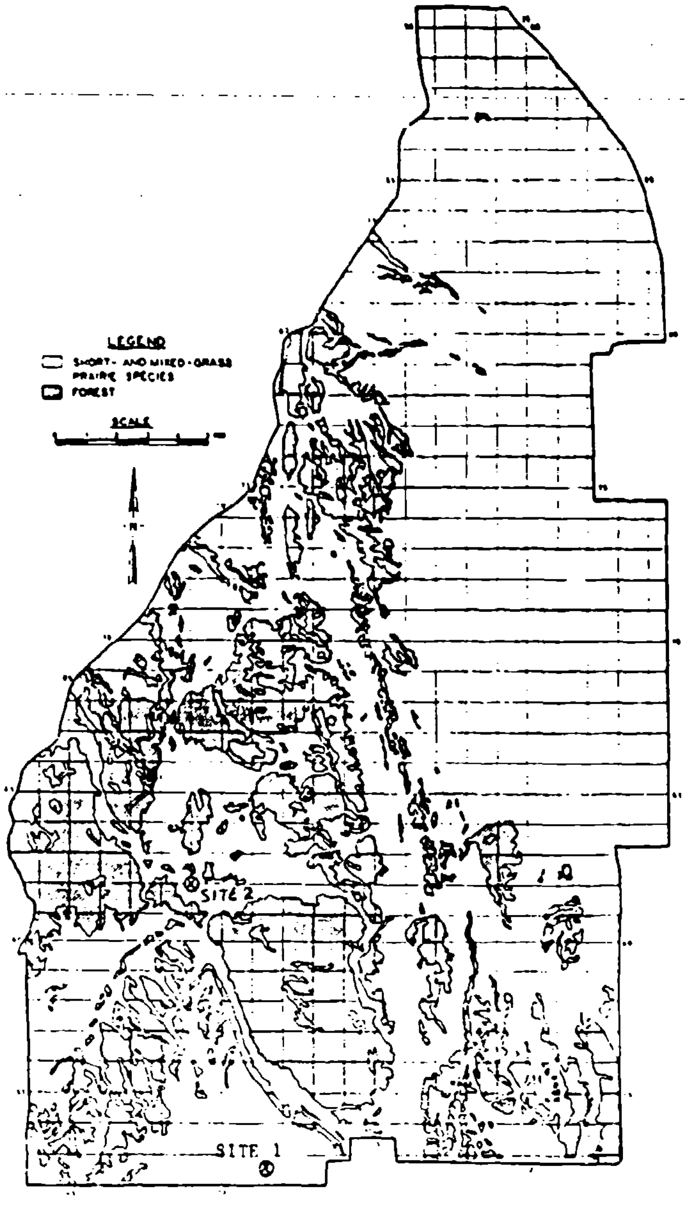


Figure 2. Vegetation cover at Fort Carson, Colo.

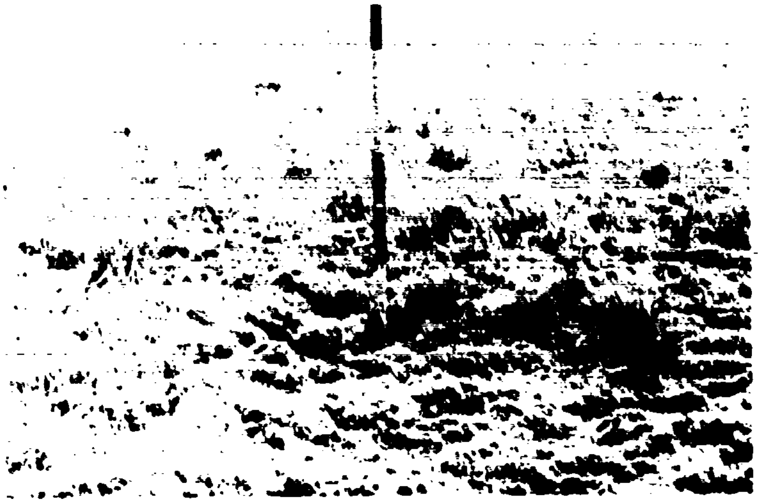


Figure 3. Site 1 (April tests, DOT I)

Figure 4. Site 2 (August tests, DOT II)

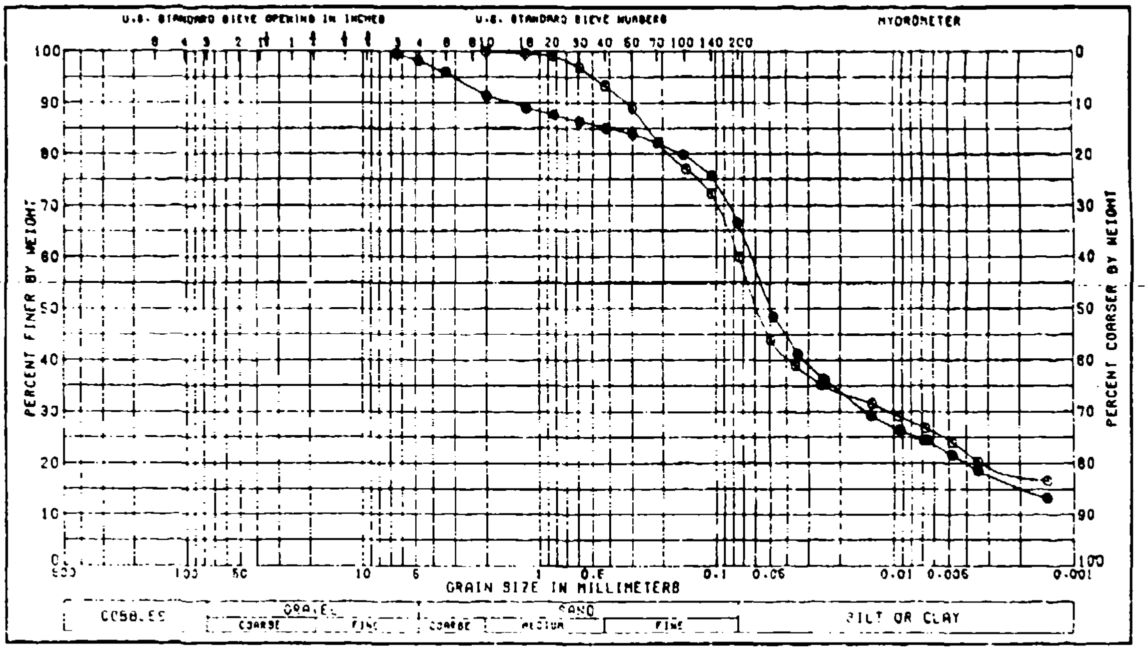


Figure 5. Average grain size distribution of surface soil at each of the two sites (● – Site 1; ○ – Site 2)

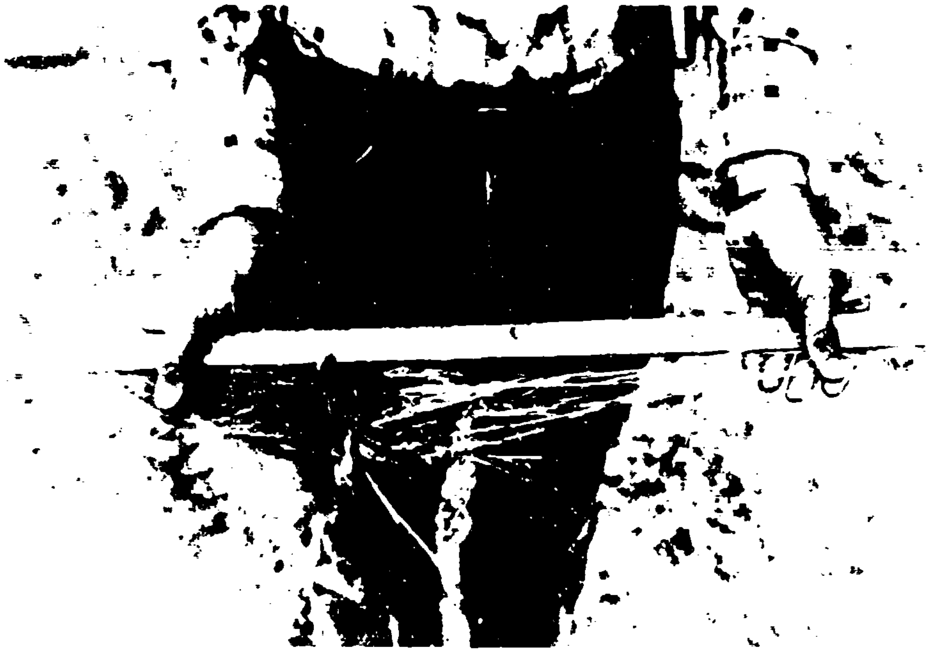


Figure 6. Typical grass root depths at Site 1

a. Site 1 (April tests, DOT I)

b. Site 2 (August tests, DOT II)

Figure 7. Instrumentation used at the DOT

and several meteorological sensors (wind speed, wind direction, air temperature, barometric pressure, relative humidity, and solar intensity) located at a height of 2 m. The instrumentation for Site 2 was provided by PEDCo Environmental, Inc., under contract to WES. The instrumentation and calibration procedures are described in PEDCo Environmental, Inc. (1985).

14. Figures 8 and 9 are schematic representations of the instrumentation and coordinate systems used for DOT I and DOT II. A rectangular coordinate system was used in DOT I while polar coordinates were utilized in DOT II. Polar coordinates for DOT II were deemed appropriate because the sampler line could be rotated in order to adjust for prevalent wind shifts. Figure 9a shows locations of shots and measuring devices for the first three shots, while Figure 9b shows those for the rest of the shots.

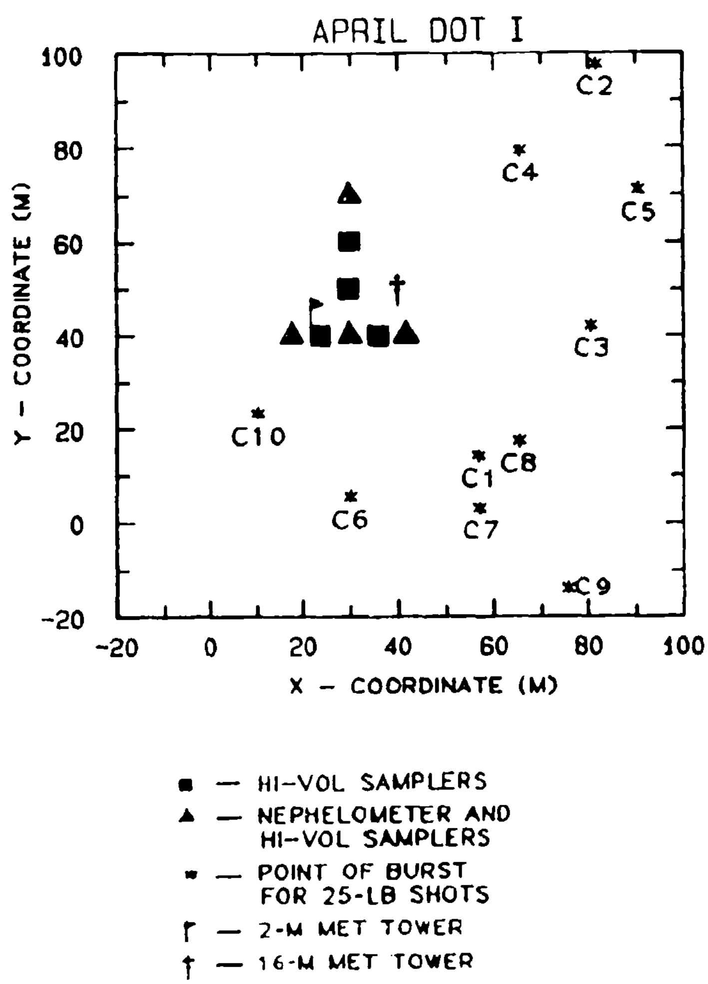
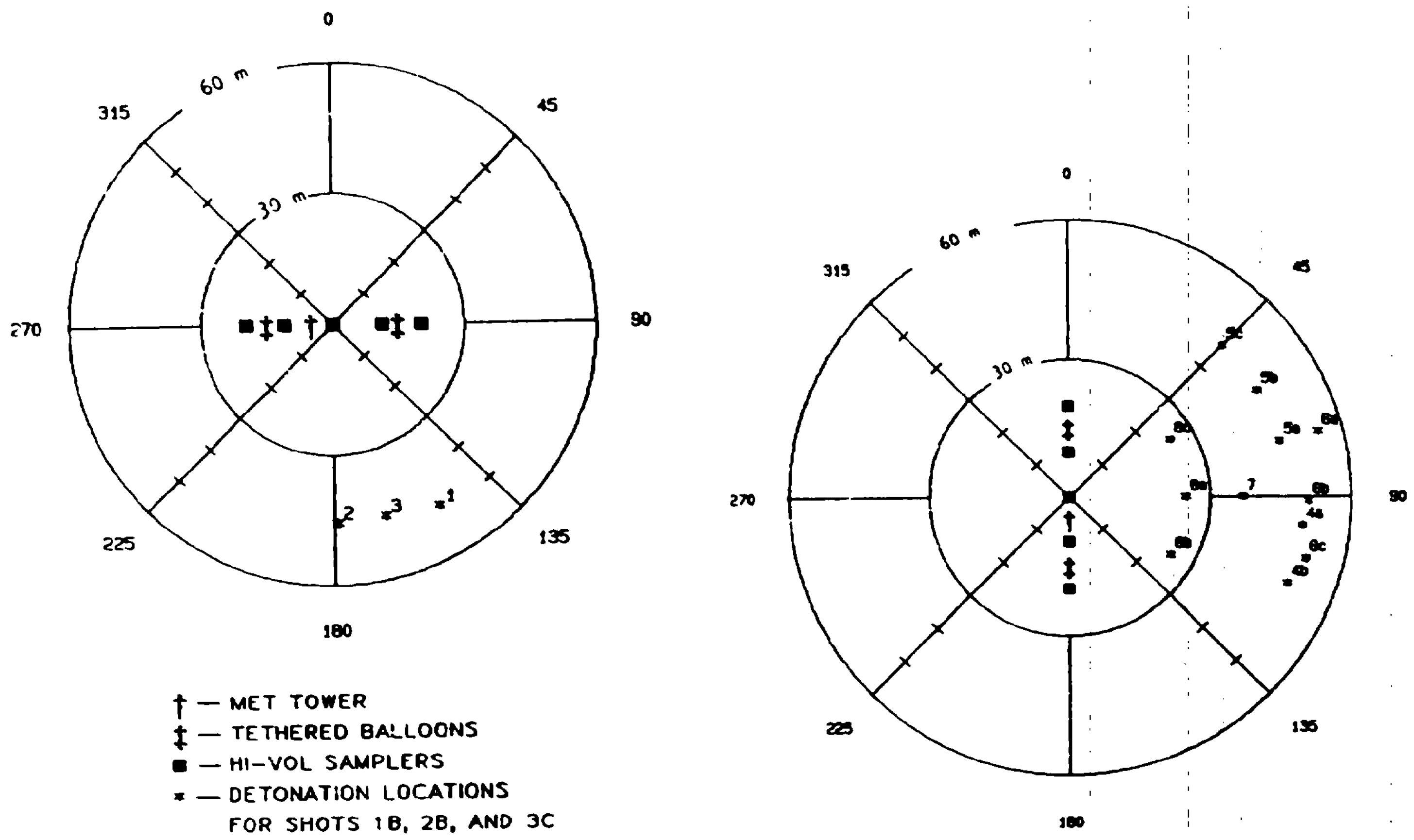


Figure 8. Schematic site layout for DOT I



a. Layout of first three shots

b. Layout of other shots

Figure 9. Schematic site layout for DOT II

Conduct of Tests

15. The explosive agent used for the DOT explosive phases was uncased C-4 detonated by personnel of the 52d Engineering Battalion, Fort Carson. Charges were either blocks or molded spheres (Figure 10) of 7.5 lb (3.4 kg, designated "A"), 15 lb (6.8 kg, designated "B"), and 25 lb (11.3 kg, designated "C"). A total of 35 shots were made during DOT I, the majority being surface tangent (ST) blasts. Trial B16 had three separate charges of 15 lb each detonated at 5-sec intervals, making it the only multiple charge shot of DOT I. The B14 shot was detonated on a stick with the C-4 center of mass at 39 cm above the surface. No crater was formed by this shot. Trials B12, B13, and B15 were surface tangent buried (STB) shots with the charges shaped as blocks formed from individual 1.25-lb (0.6-kg) bricks of C-4 and placed in the ground with the top of the charge flush with the surface. The B5 trial was unusual in that the charge was inadvertently placed over a soil sample plug hole 1.5 in. (3.8 cm) in diameter and 8 in. (20.3 cm) deep. The true and apparent crater volumes resulting from this shot were approximately three and five times larger than those of the respective B shot means. Evidently the plug hole caused a focusing of the blast energy.

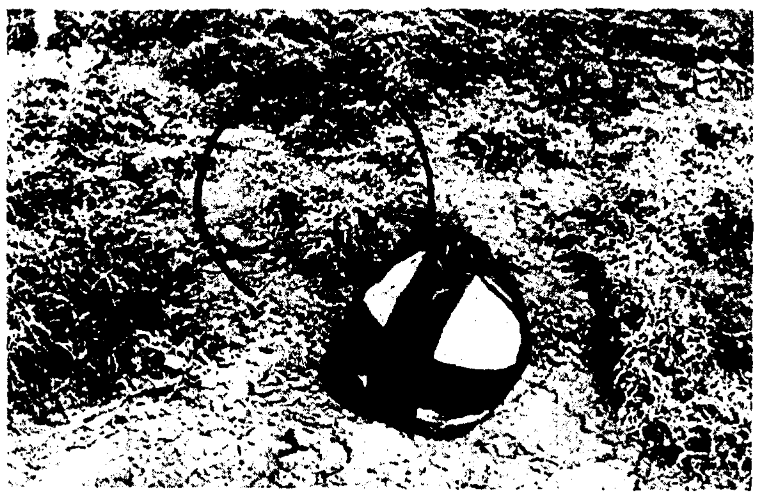


Figure 10. Typical molded C-4 sphere

16. The DOT II high-explosive phase consisted of eight shots, four of which were multiple-detonation trials. However, only seven of the trials yielded data because the Hi-Vol sampler filters were blown out by the blast in Trial 8. Charges for the measurable DOT II shots were 15- and 25-lb spheres.

17. The location for the point of burst (POB) was an important consideration for the tests. The POB for the April tests was determined by using the onsite measured wind direction and speed data and the center (location of sampler 3) of the Hi-Vol sampler array. The actual POB was determined by using the direction from which the wind was blowing and selecting a distance from the Hi-Vol array that would allow representative measurement of the horizontal and vertical composition of the dust cloud. The POB distance ranged from 19-75 m for all of the April tests, while the POB distance range for the August tests was somewhat less (40-45 m).

18. Tables 1 and 2 provide reference logs for the high-explosive trials at the DOT. Both timed still photographs and video records were taken for most of the DOT I events. A typical young cloud generated by a 15-lb C-4 charge is shown in Figure 11. Note the significant amount of dust (appearing white in Figure 11) generated to the 2- to 3-m heights by the detonation shock waves. The craters were measured immediately after the blast as shown in Figure 12.

a. Dust cloud at time 0.1 sec

b. Dust cloud at time 0.5 sec

c. Dust cloud at 1.0 sec

Figure 11. Dust cloud generated at DOT I (April 1983) using a 15-lb C-4 charge

Figure 12. Measurement of crater following static surface tangent detonation of C-4

PART III: DATA COLLECTED

19. Data from the DOT I and DOT II high-explosive trials are presented in Appendix A. The DOT I data are the more comprehensive set, reflecting the instrumentation differences between the April and August trials. However, some additional information concerning the meteorology, Hi-Vol sampler data, and balloon sampler data obtained during DOT II are included in the WES contract report by PEDCo Environmental, Inc.

DOT I Event Data

20. The DOT I (April 1983) data are presented in Appendix A (pages A3–A180) in sequence by charge weight, starting with the A (7.5-lb) shots. Figure 13 shows typical data for one shot, as presented in Appendix A. At the beginning of each charge weight group is a schematic diagram locating the Hi-Vol sampler positions and the location of each shot for the data set (Figure 13a). The meteorological, transmissometer, Hi-Vol, nephelometer, and Gelman data have been reduced and provided by ASL. Crater profiles, crater volumes, cone indices, soil densities, and soil moisture contents have been measured and/or calculated by WES. Information for each shot includes an Event Summary Table (Figure 13b) followed by a crater profile plot (Figure 13c), a cloud track and Hi-Vol data plot (Figure 13d), time-dependent nephelometer concentration plots (four stations) (Figures 13e–f), time-dependent transmission plots (four bandpasses) (Figures 13g–h), plots of visibility, solar flux, and sky and target voltages (Figure 13i), and time of obscuration histograms for four levels of transmission (four bandpasses) (Figure 13j). The following comments pertain to the DOT I data.

Meteorological data

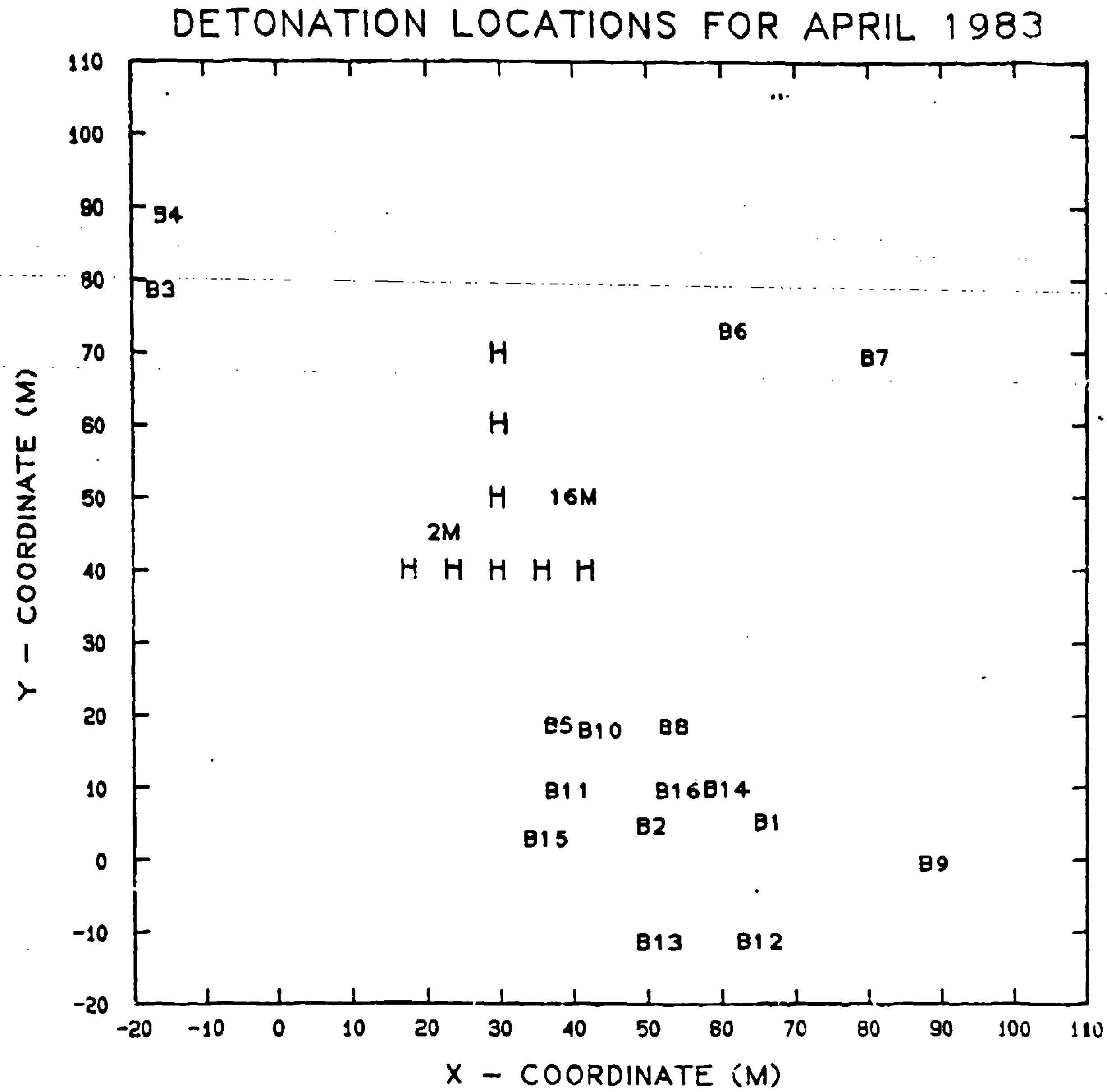
21. The 2-m tower data are not presented in this report. The 16-m tower data are presented in tabular form as mean values for the 2-, 4-, 6-, and 16-m levels (Figure 13b). These means are computed for the 2-sec sampling intervals, which usually began several minutes before the detonation (event time) and continued until the cloud was well past the data acquisition instrumentation (usually 5 to 10 min). The "start" time and "end" time values identify this 2-sec sampling period for each shot.

22. The soil temperature, dew point, air temperature, relative humidity, and absolute humidity data are also means computed during the 2-sec sampling period (Figure 13b). The solar flux, visual range, Vista Ranger, and sky-target contrast data are the values observed at the start time given for each shot. Mean values for these data were not computed, as these data are strongly affected by dust cloud trajectory and location. However, the time-dependent plots of these variables are displayed for each shot.

23. The Richardson number values presented are means computed from both the 2- and 16-m levels and have been noted to be noisy.

Cone index

24. Cone indices were acquired for most shots before (pre-shot) and after (post-shot) the detonations (Figure 13b). These indices are presented for surface (SFC) and 15-, 30-, and 45-cm depths. The 15-, 30-, and 45-cm values, however, are averages for 0–15, 15–30, and 30–45 cm, respectively. The maximum value the instrument would register was 750. Any excess of this maximum value is logged as 750+ in the event summary CI data.



a. Schematic diagram of POBs (DOT I)

Figure 13. Data items for typical 15-lb C-4 event (Sheet 1 of 6)

EVENT SUMMARY DATA

Test Number: HEB6

Date: 22 APRIL 83

Detonation Coordinates (M):
X: 61.7
Y: 72.7

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 11:22:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.020

16 Meter Tower (Means)
Start Time: 11:20:49 End Time: 11:24: 1

	2M	4M	6M	16M
Wind Speed (M/S)	6.20	7.07	7.17	8.65
Wind Dir. (DEG)	32.7	29.8	32.3	27.4
Sigma WSP	1.00	1.15	1.08	0.94
Sigma WDIR	10.5	9.4	8.6	7.0
U/W Components				
U (N-S) (M/S)	-5.15	-6.08	-6.01	-7.64
V (E-W) (M/S)	-3.25	-3.42	-3.75	-3.92
W (Vert) (M/S)	0.46	-0.04	0.65	*
Sigma U	1.16	1.30	1.18	1.03
Sigma V	0.96	0.97	0.96	0.95
Sigma W	0.22	0.32	0.34	*
Temperature (C)	11.0	10.9	10.8	10.6

Soil Temperature (C): 11.7

Dew Point (C): 2.7

Temperature (C): 10.2

Rel. Hum. (%): 59.4

Abs. Hum. (G/M**3): 5.69

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 131.5

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: *
Target: *

Sky-Target Contrast: *

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	62.0 73.0	26	192	308	667
Post-Shot	62.0 73.0	25	70	130	195

CRATER DATA

Moisture Content: 13.1

CRATER VOLUMES (M**3):
True Crater: 1.260
Apparent Crater: 0.231
Flow: 1.029

DENSITIES (G/CM**3):
Pre-Shot: 1.380
Flow: 1.040
Bottom: 0.975
Side: 1.104

HI VOL DATA (G):

HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0147	0.0693	0.1081	0.1129	0.0568	0.2123	0.0049	0.0059

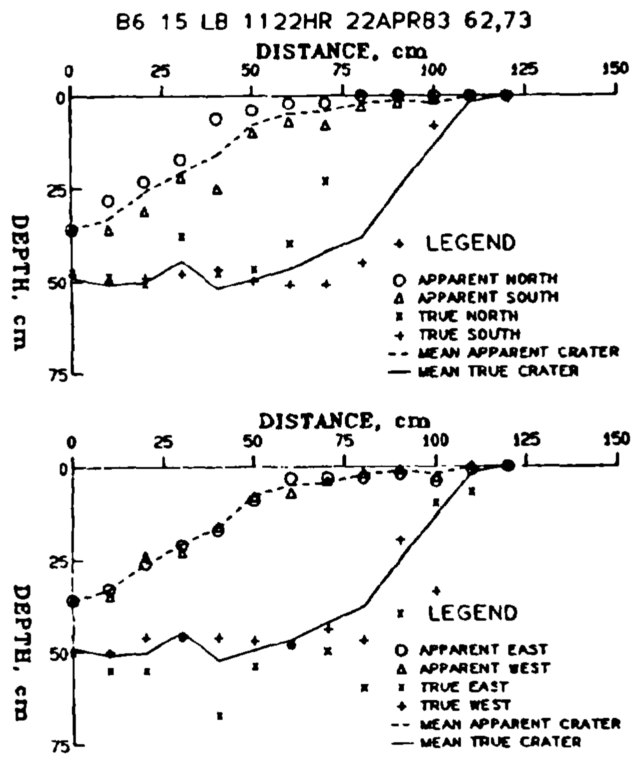
SUM: 0.6249

GELMAN DOSAGE (G S/M**3):

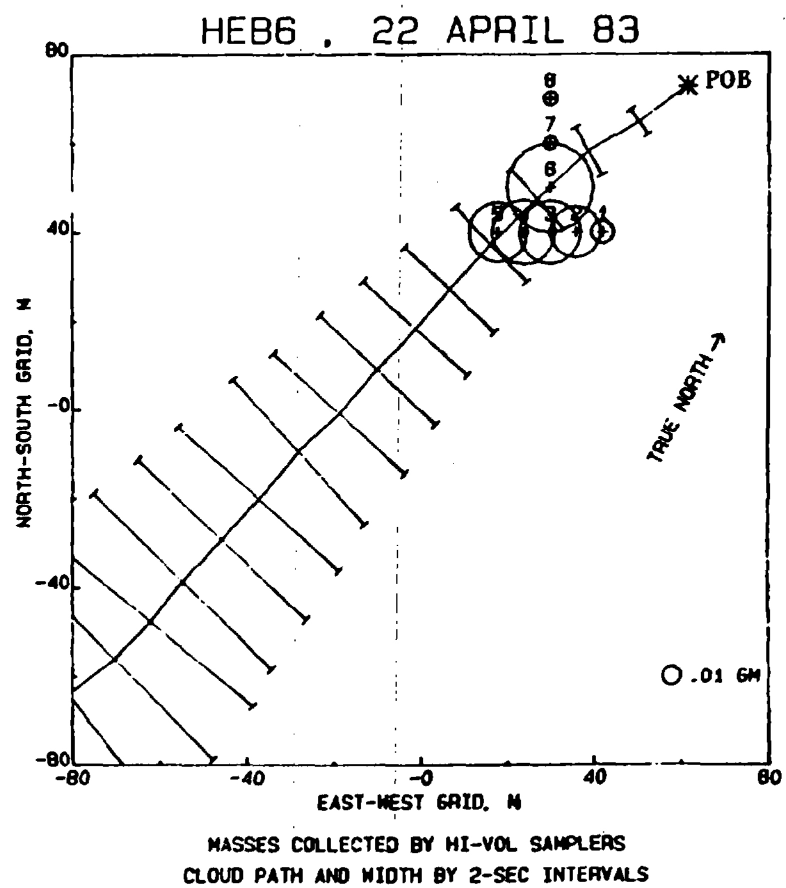
GELMAN A	GELMAN B	GELMAN C	GELMAN D
16.114	55.200	76.961	67.568

b. Event Summary Data

Figure 13. (Sheet 2 of 6)

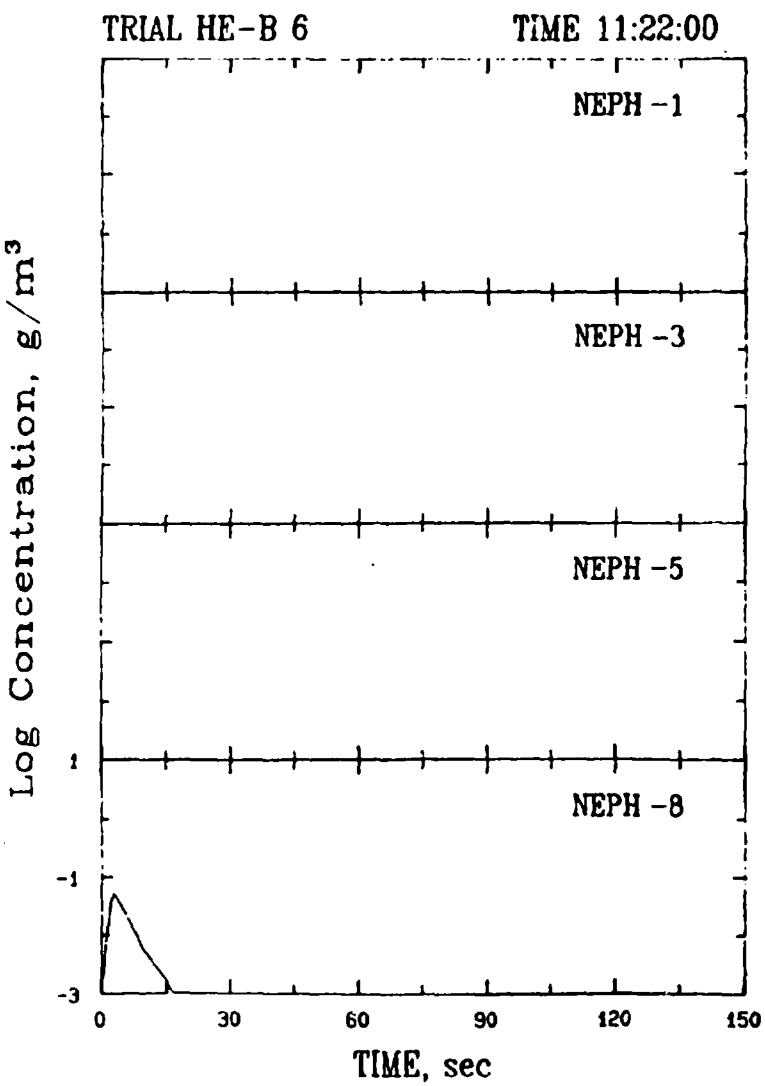


c. *Radial crater profile plots*

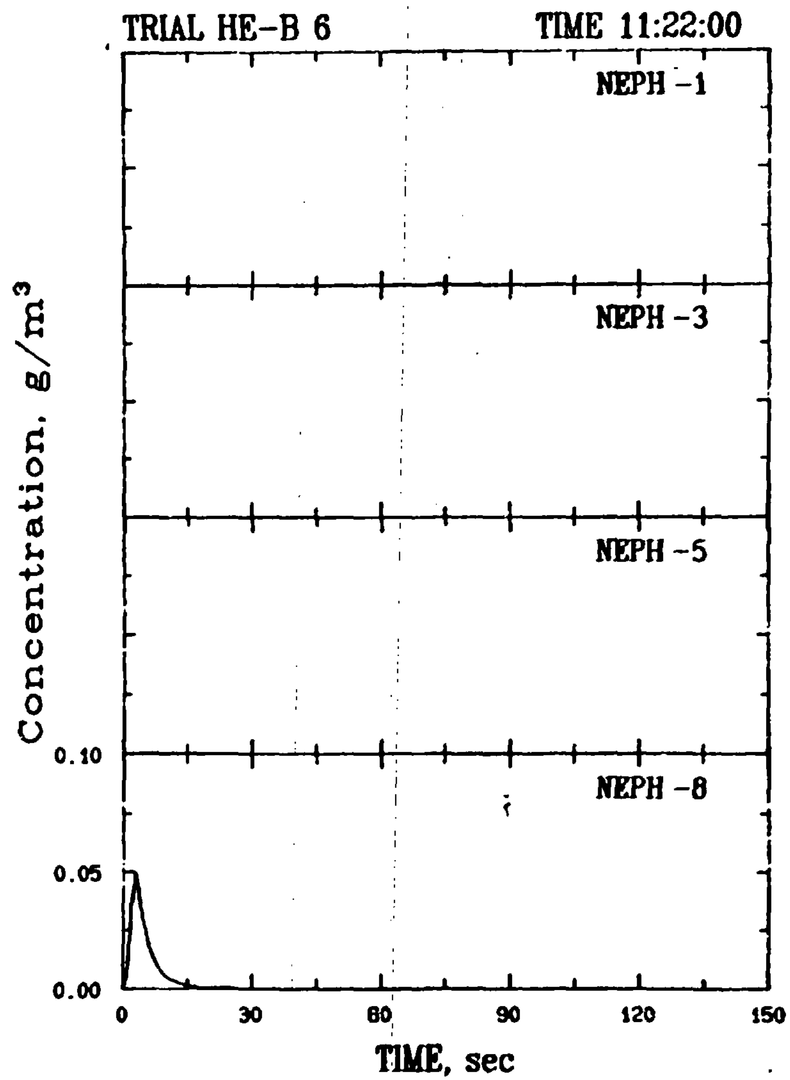


d. *Dust cloud m_sses collected by Hi-Vol samplers with predicted cloud path and width by 2-sec intervals*

Figure 13. (Sheet 3 of 6)

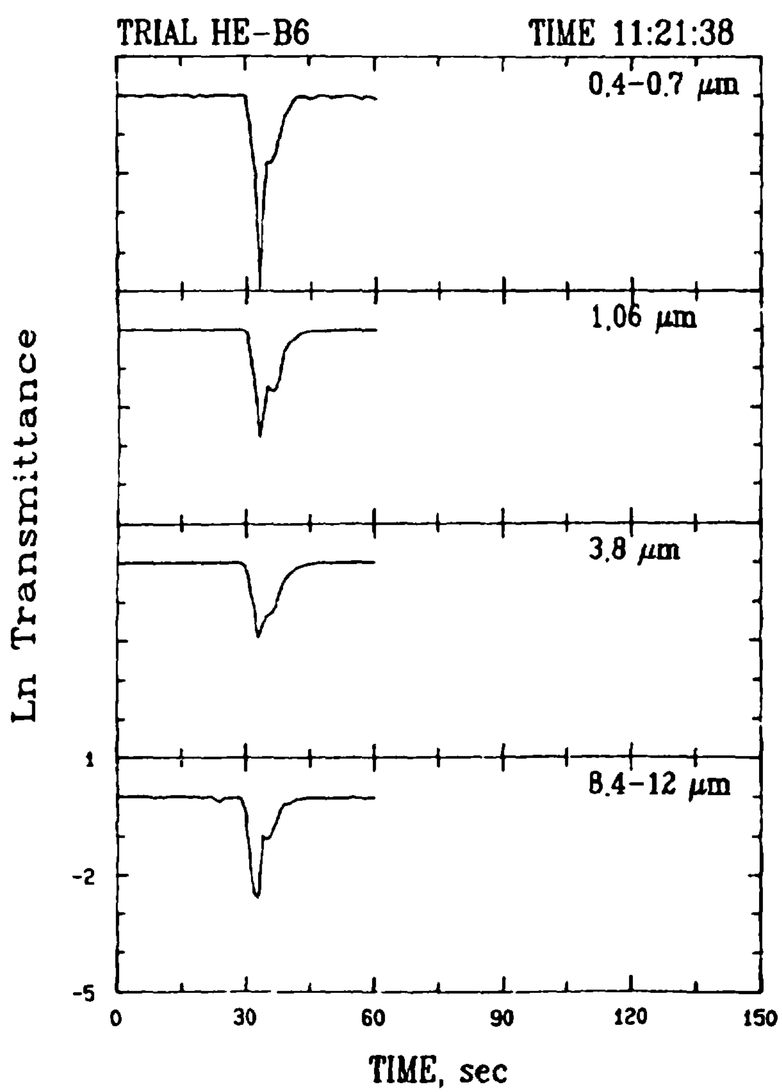


e. *Time-dependent nephelometer log concentration plots*

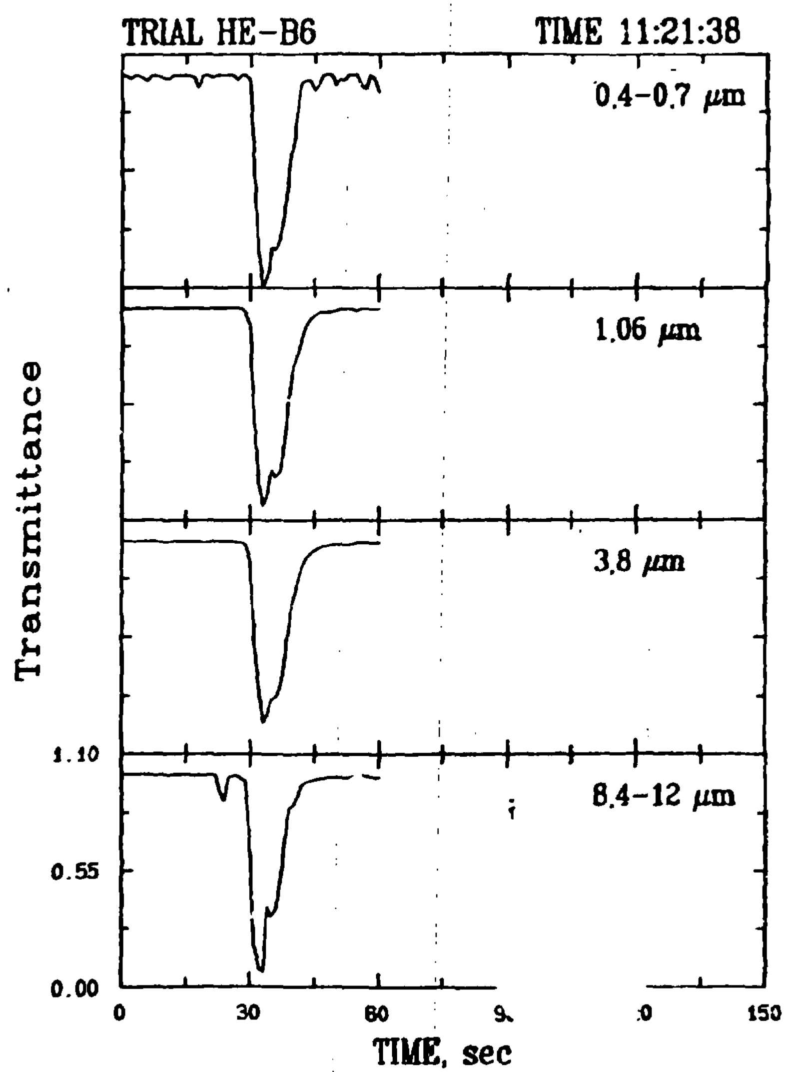


f. *Time-dependent nephelometer concentration plots*

Figure 13. (Sheet 4 of 6)

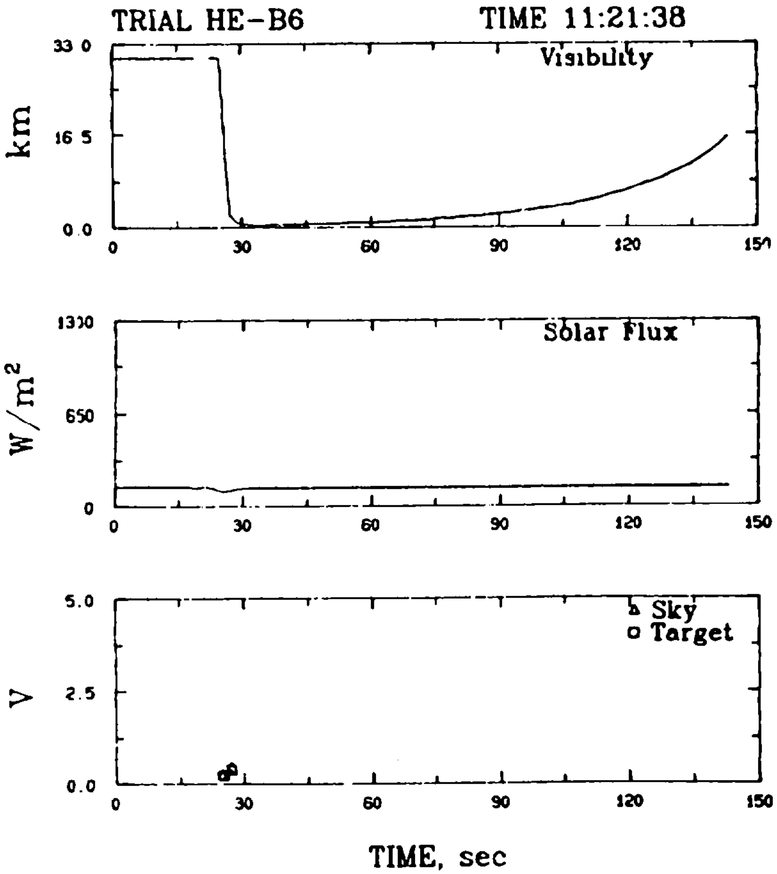


g. *Time-dependent natural logarithmic transmittance plots*

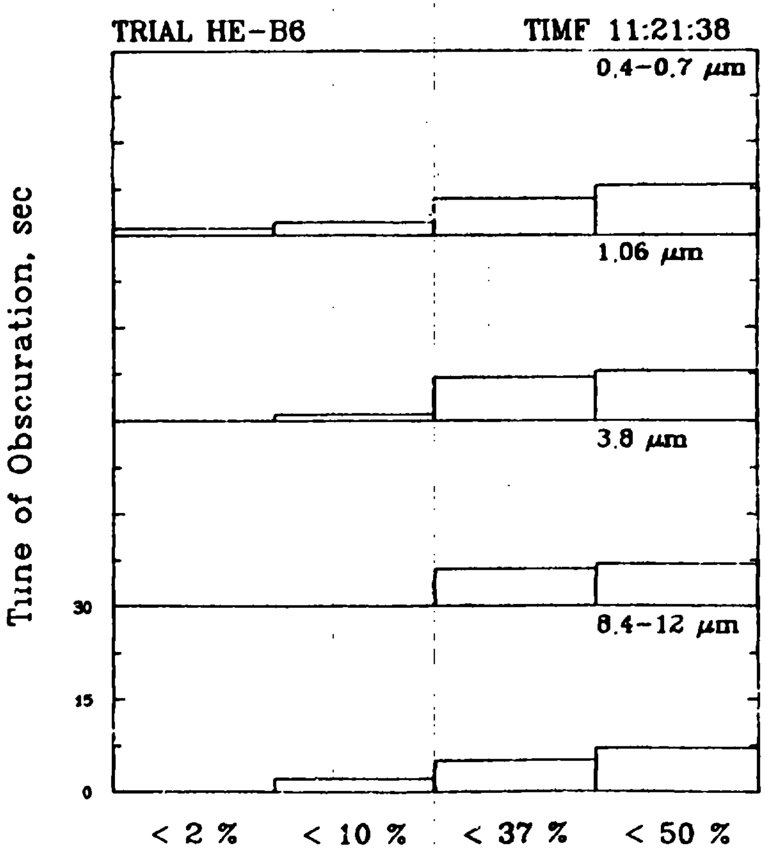


h. *Time-dependent transmittance plots*

Figure 13. (Sheet 5 of 6)



i. Visibility, solar flux, sky and target voltages



j. Time of obscuration histograms

Figure 13. (Sheet 6 of 6)

Crater data

25. The crater data include soil moisture content, crater volumes, and soil densities both before and after the shot.

26. *Crater volumes.* A number of different approaches were tested for calculating crater volumes. The approach that apparently yields the most accurate results is a Simpson's rule integration. Four volumes for each crater were determined using a vertical through the crater center as the axis of rotation for each quadrant profile (see discussion of crater profiles below). The calculated volumes defined by the resulting surface of revolution for each quadrant profile were then averaged to yield the volumes presented in this summary. The flow volume refers to the volume of material which includes sheared material ejected with insufficient energy to carry it past the crater rim and ejecta which has fallen back into the crater. The flow volume is the difference between the true crater volume and the apparent crater volume.

27. The flow density given is a mean value of several samples taken from the flow material. Often this is just the mean of the bottom and side flow densities, as given in the event summary table.

28. *Crater profiles (Figure 13c).* Crater profiles, that is, the depths of the apparent and true crater surfaces, were measured along east-west and north-south diameters. The apparent crater was measured from the surface to the crater floor, i.e., the top of the flow in the crater. The true crater was measured from the surface to the point at which the measuring stick was perceived to encounter a significant change in soil structure when pushed through the flow material, i.e., the bottom of the flow material. This measuring technique is expected to yield more accurate apparent crater profiles than true crater profiles. This expectation is confirmed in the large scatter in the calculated true crater volumes (see Part IV, paragraph 46).

29. The crater profile information is displayed in two plots for each shot, one plot displaying the north-south quadrant profiles and the other presenting the east-west quadrant profiles. Apparent and true crater profiles are displayed together for easy comparison. The solid and dashed lines appearing on each plot are formed from averages computed from all four quadrants for the true and apparent craters, respectively.

Cloud data

30. *High-volume samplers (Figure 13d).* Complete descriptions of the Hi-Vol samplers and reduction techniques are found in the ASL reports on the DOT test. Presented here are the masses (in grams) accumulated by the Hi-Vol samplers for each test shot. Also, the individual Hi-Vol masses for each shot have been added and recorded as "Sum" in the Hi-Vol data presented in the event summary table. This sum has no quantitative significance other than to benchmark the cloud track relative to the sampler array. The Hi-Vol masses and predicted cloud tracks determined from the observed winds are displayed graphically in Appendix A (see following discussion).

31. *Cloud tracks (Figure 13d).* In order to provide a visual representation of each shot, cloud transport and diffusion are displayed with the Hi-Vol sampler data. The transport of the cloud was predicted by use of the 2-sec interval wind speed and direction data acquired at the 2-m level of the 16-m tower. (The Hi-Vol samplers were 1.5 m above the ground.) Assuming a Gaussian cloud, the diffusion is approximated in the horizontal by

$$\sigma_y = ax^b$$

where σ_y is the standard deviation in the horizontal direction perpendicular to the wind direction. The coefficients *a* and *b* are Brookhaven National Laboratory (BNL) parameters (Hanna, Briggs, and Hosker 1982) and *x* is the downwind distance.

32. These standard deviations computed with the BNL parameters tend to be representative of the lower portion of the clouds' mass distributions. To support this conjecture, the Hi-Vol sampler positions and their respective recorded masses are also displayed on these plots. The relative Hi-Vol masses are reflected by the areas of the circles centered on the sampler positions.

33. The predicted dust cloud tracks represent remarkably well the paths taken by the individual clouds as confirmed from the video records of the shots.

34. *Nephelometer data (Figures 13e-f).* The nephelometer data for those instruments placed adjacent to the Hi-Vol sampler stations Nos. 1, 3, 5, and 8 are presented as time-dependent plots. A complete description of the instruments and reduction procedures is given in ASL reports of the DOT test (Bruce, Unthank, and Jelinek 1985; Hoock*). The reduced data in grams per cubic metre are presented here as both linear and logarithmic (base 10) representations. Passage of the shock dust and cloud is easily identified in the nephelometer data. Occasionally, data are missing due to acquisition problems.

35. *Transmissometer data (Figures 13g-h).* As with the nephelometer data, a complete description of the instrumentation and data reduction is found in ASL reports. The transmission data are presented as a function of time in both linear and natural log representations. Shock dust is more difficult to observe in the transmissometer data since the line-of-sight (LOS) was nearly a metre above the nephelometers. However, the shock can be seen in many of the trials. Note that the time at which the transmissometer data start is not the same time as the event time.

36. *Other data (Figure 13i).* Visibility, solar flux, and sky and target voltages were acquired in some of the DOT I events. These data are likewise presented in Appendix A, with the appropriate event, if they were available.

37. *Time of obscuration (Figure 13j).* To estimate quantitatively the obscuration potential of the high-exlosive dust clouds, total time of transmission below the 50, 37, 10, and 2 percent levels has been determined from the transmissometer data. These results have been calculated for those clouds which passed between the transmissometer transmitter and receiver in all four bandpasses and are displayed as histograms. These times of obscuration are the actual observed times at the transmissometer LOS and have been neither corrected for wind direction nor normalized to a common wind speed. These modifications to the data are presented later in the text (Part IV, paragraph 85).

DOT II Event Data

38. The DOT II (August 1983) data comprise the second part of Appendix A (pages A181-193). The data are grouped by charge sizes with the 15-lb charges designated B and the 25-lb charges designated C. Since there were no 7.5-lb charges, no shots were designated A as for DOT I. No data were recorded for the final DOT II shot because it blew the samplers away and thus no data were collected. DOT II data are not nearly as voluminous as those of DOT I because no

*Personal Communication, 1984, D.W. Hoock, US Army Atmospheric Sciences Laboratory, White Sands Missile Range, N. Mex.

transmissometer, nephelometer, or high time-resolution meteorological data were taken. Likewise, only eight trials were attempted in DOT II whereas 35 were attempted in DOT I.

39. The field trial identification for DOT II was made by numbering the trials sequentially, including both the vehicular and high-explosive trials. For purposes of this report the trial identification has been altered to match more closely that of DOT I. The high-explosive trials for DOT II are identified by the following notation:

$$HEmp-n$$

where

m = the sequential number of the high-explosive trial starting with $m = 1$
p = the charge weight identifier, either B (15 lb) or C (25 lb)
n = the charge identifier (A, B, C) if multiple charges were detonated for the trial

Note that the DOT II Event Summary Data tables include the field trial test number in parentheses for cross-reference purposes.

40. Hi-Vol and Gelman sampler data are presented in the WES draft contract report by PEDCo Environmental, Inc., and are therefore not included in this report.The meteorological data, crater profiles, crater volumes, soil densities, soil moisture contents, and cone indices are provided in the DOT II Event Summary Data tables (Appendix A).

41. The summary data are preceded by two graphical representations of the DOT II field coordinate system which mark the sampler line and POBs for the high-explosive shots (see pages A181 and A185). Note that the sampler line was rotated 90 deg after the first three trials in order to adjust for a wind shift. The vertical samplers were positioned by tethered balloons, one between the rightmost two Hi-Vols and one between the leftmost two Hi-Vols. The meteorological station was positioned near the center Hi-Vol.

Soil Classification Data

42. Acquisition of data for soil characterization at the DOT sites included soil samples taken at various depths in approximately 2-m-deep pits (dug by backhoe) and in shot craters. Presented in Appendix B are summary tables (pages B3 and B18), pit profiles (pages B4–B6), and soil gradation curves (B7-B17 and B20-B34) from soil samples obtained at the DOT I and II sites. Information provided in the individual curve figures includes the site location and depth of the sample, liquid and plastic limits, specific gravity, and organic content. Mean curves (Figure 5) have been formed for both sites and yield percent finer values of 67 and 60 percent for Sites 1 and 2, respectively. Cone index data acquired at the shot locations are found in the individual Event Summary Data tables of Appendix A.

PART IV: DATA REDUCTION AND ANALYSIS

43. One of the most obvious results of a high-explosive surface blast is the excavation of a crater. Consequently, much initial work in field tests similar to DOT sought to infer dust cloud masses from crater volumes under the assumption that only the percent fines less than some specified diameter composed the cloud. It was soon recognized, however, that mass predictions based on this assumption greatly overestimated the cloud masses and that only a very small fraction of the excavated crater volume remains in the sustained clouds.

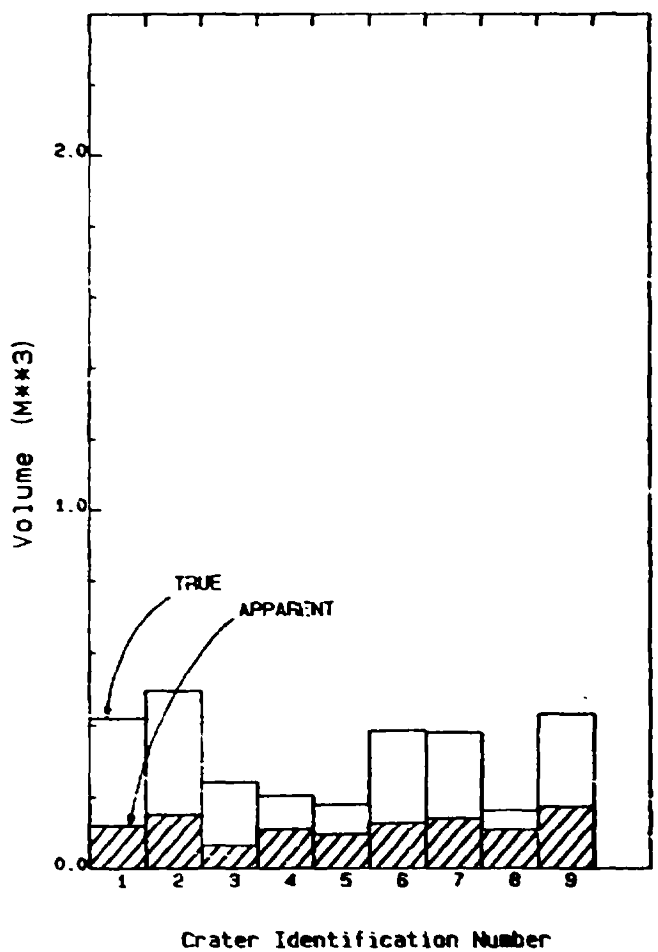
44. The problem of identifying relationships among explosive charge weights, crater volumes, and resulting dust cloud masses is complicated by a host of variables that include soil compaction during crater formation, fallback material into the craters, soil/terrain properties, and ejecta which does not become part of the sustained clouds. Because of the compounding factors and the fact that only a small fraction of the excavated mass remains lofted, a large error potential exists in formulating charge weight-crater volume-cloud mass relationships. The DOT test was designed to minimize the errors in defining these relationships by providing direct measurements of dust cloud mass loading in both the horizontal and vertical planes. The results of the DOT data analysis are presented below.

Crater Volumes

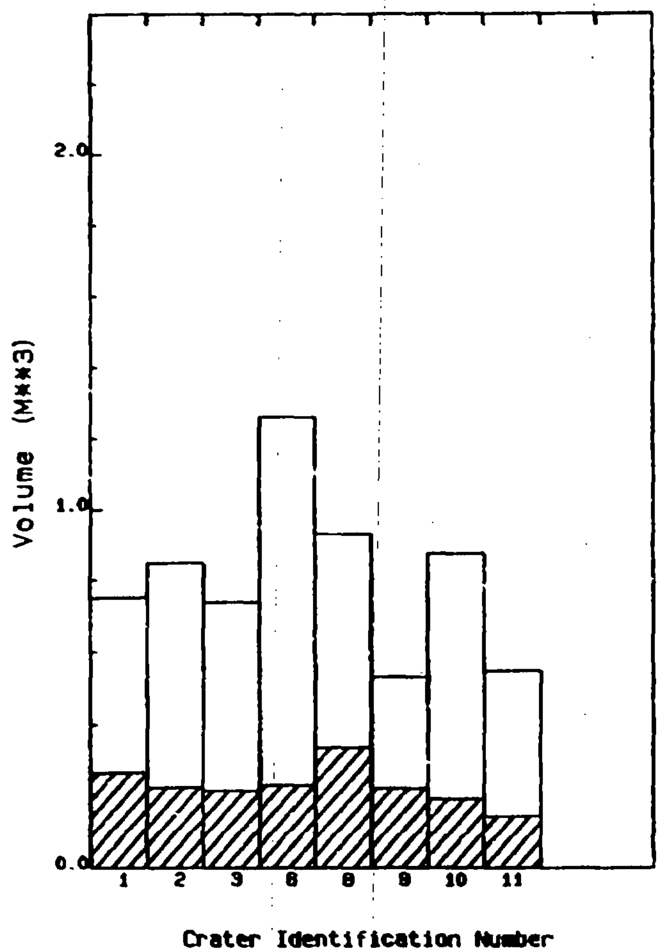
45. Twenty-nine crater profiles were measured during DOT I, and 10 such profiles were measured during DOT II. Appendix A contains plots of the individual profiles, and the measurement procedure is described in Part III of the text. From the profile data, true and apparent crater volumes were calculated using a modified Simpson's rule. Table 3 includes these calculated volumes as well as soil densities, moisture contents, bulking factor (i.e., the ratio of pre-shot to post-shot densities), and volumes normalized to the charge weights.

46. Figures 14a–d (DOT I) and 15a–b (DOT II) provide histograms of the true and apparent volumes determined for the individual craters; Figures 16a–d present plots of these volumes versus explosive charge weights. The DOT I volumes show a wide scatter in true volumes, while the apparent volumes show much more consistency. This result suggests that the true crater profiles determined from the DOT I tests probably were more prone to measurement error than the apparent crater profiles. A possible cause for the inability to measure the true profiles more precisely may be that substantial fracture zones were established at the true crater boundaries, thereby causing an ambiguity in the determination of the boundaries. That is, the depths for the true crater profiles were not measured directly; they were determined by forcing a graduated range pole through the loose material commonly called fallback. Thus, overestimations were possible should the pole be overextended into the true crater "fracture zone" or underestimations were possible should the vertical path to the true crater boundary be blocked by dense fallback material. In contrast to the DOT I volumes, the true crater boundaries measured in DOT II appear to be more consistent from crater to crater.

47. Additional differences between the DOT I and DOT II craters are highlighted by calculating mean crater profiles for each charge weight. Four profiles were measured from the center of the crater to past the crater rim along north-to-south and east-to-west radii (see Part III, paragraph 28). These four radii profiles, one for each quadrant of the crater, were generated to employ the modified Simpson's rule techniques to calculate the crater volumes. Mean profiles (true and apparent) presented in Figures 17a–f have been calculated for each charge weight group and detonation configuration (i.e., ST or STB) by averaging all quadrants of all craters in their respective groups.

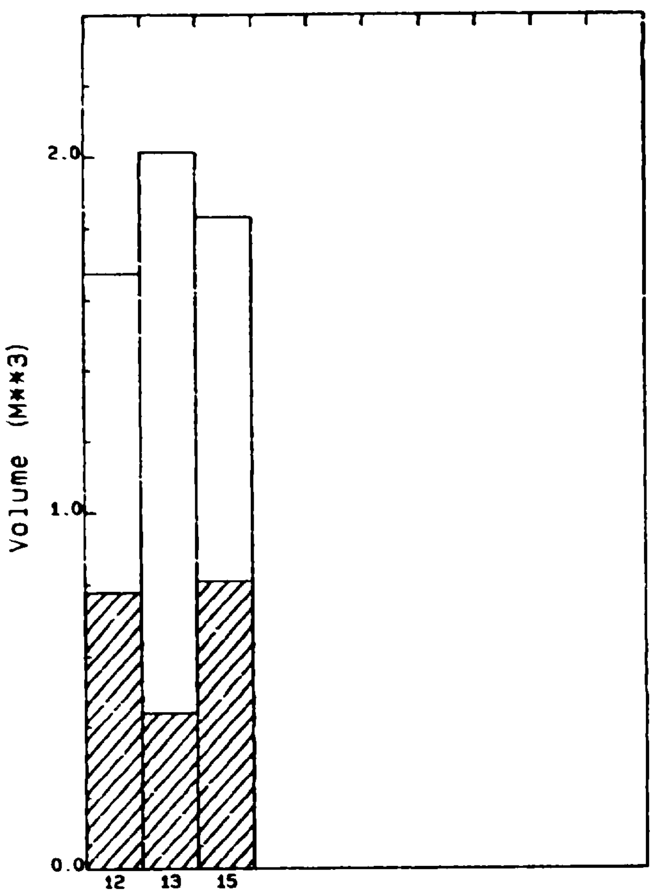


a. 7.5-lb charge

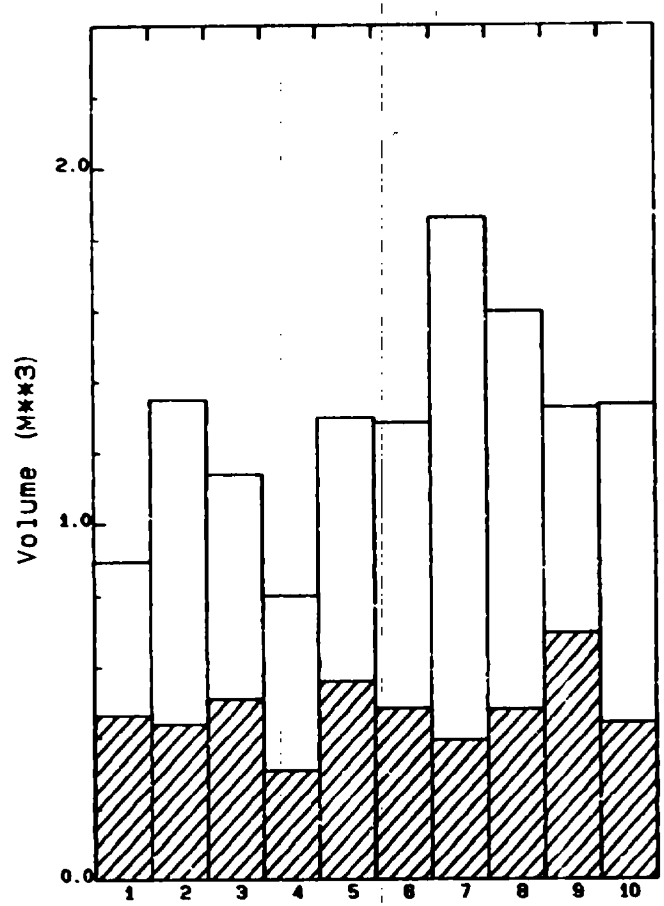


b. 15-lb charge

Figure 14. Volumes of true and apparent craters, DOT I (April 1983) (Continued)

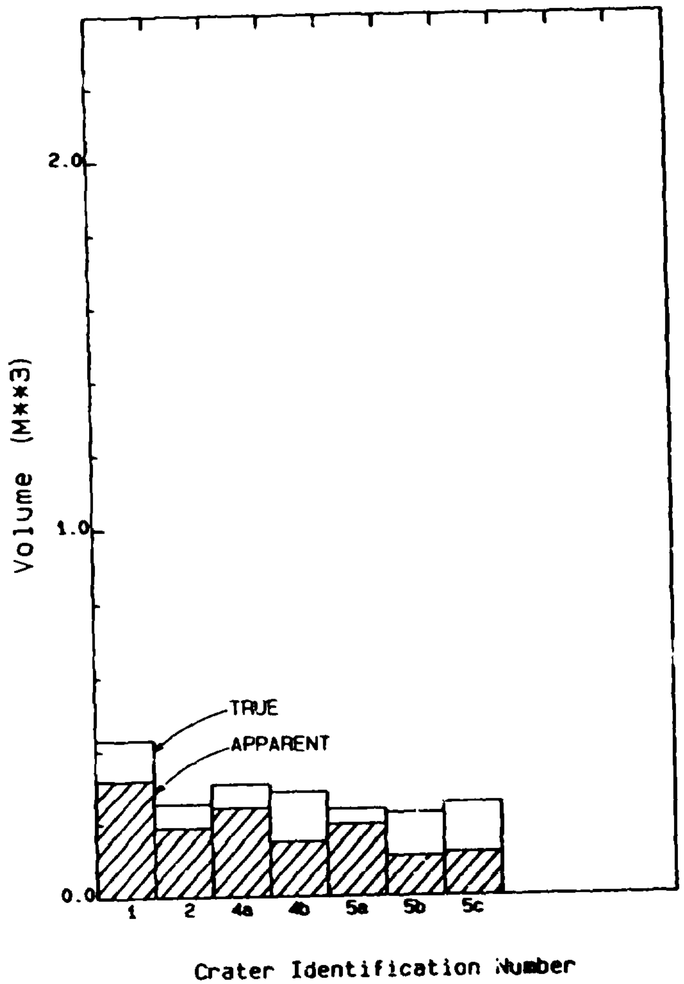


c. 15-lb charge

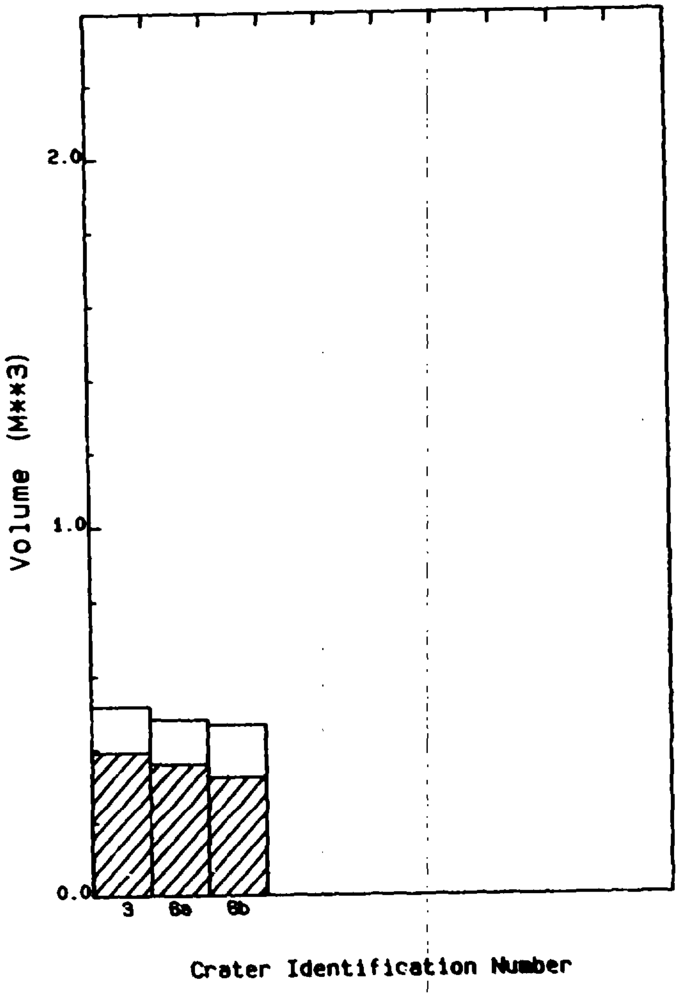


d. 25-lb charge

Figure 14. (Concluded)

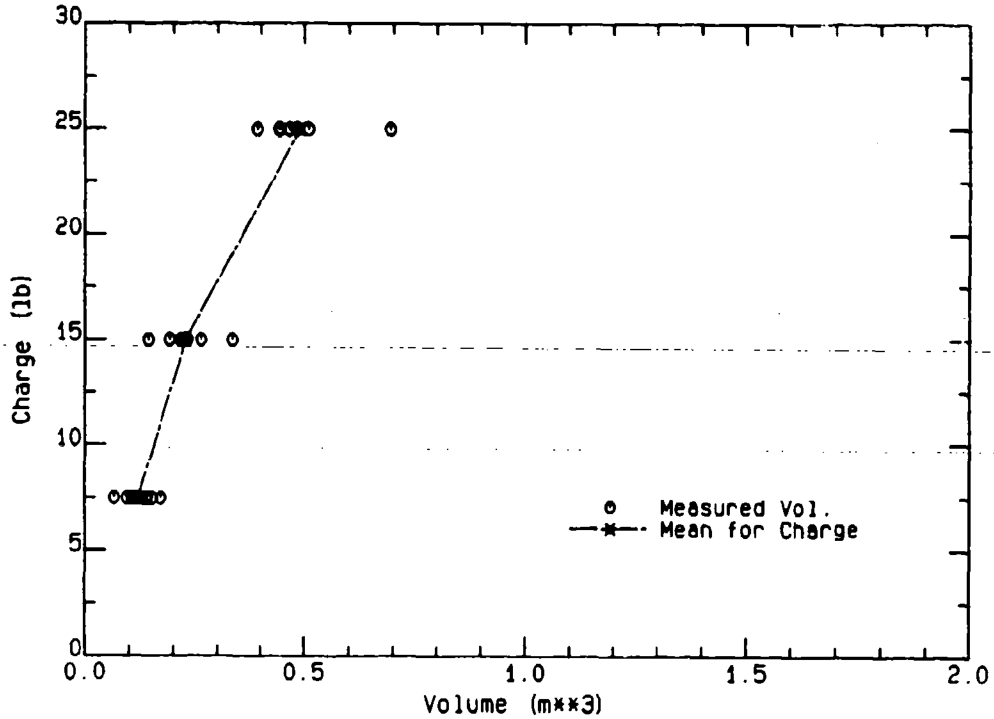


a. 15-lb charge

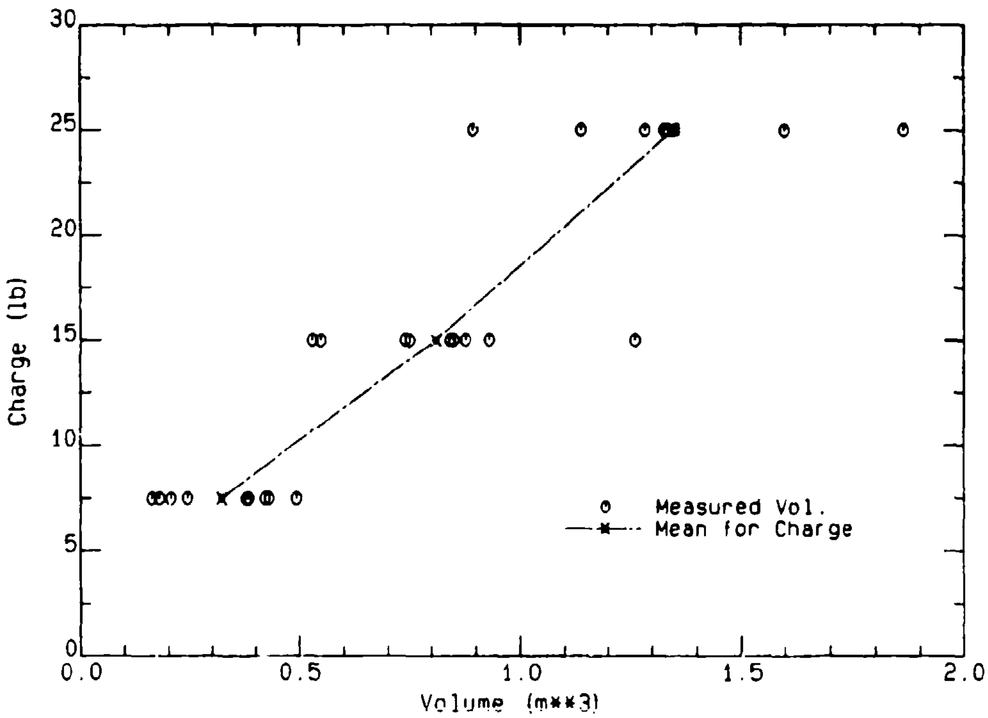


b. 25-lb charge

Figure 15. Volumes of true and apparent craters, DOT II (August 1983)

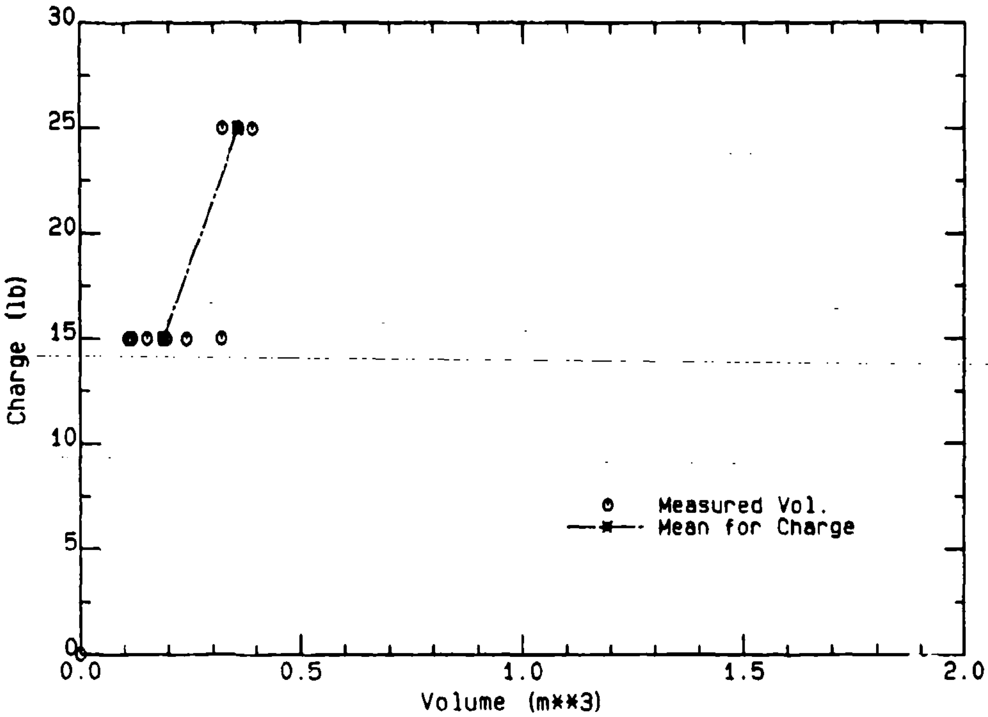


a. Apparent volume, DOT I

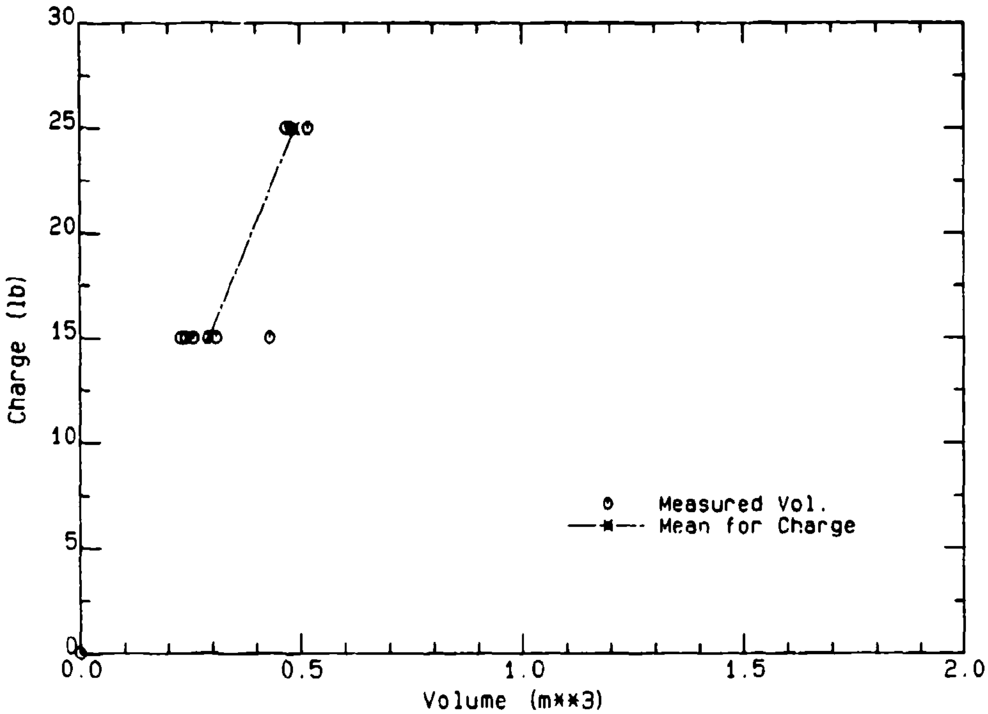


b. True volume, DOT I

Figure 16. Plots of apparent and true crater volumes versus charge weights (Continued)

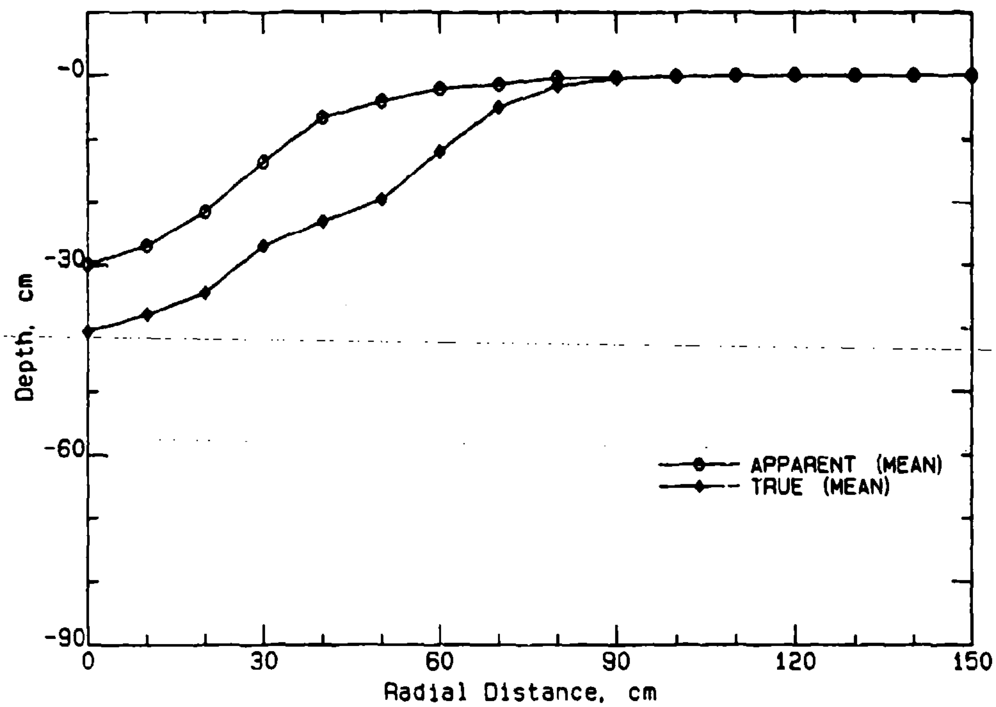


c. Apparent volume, DOT II

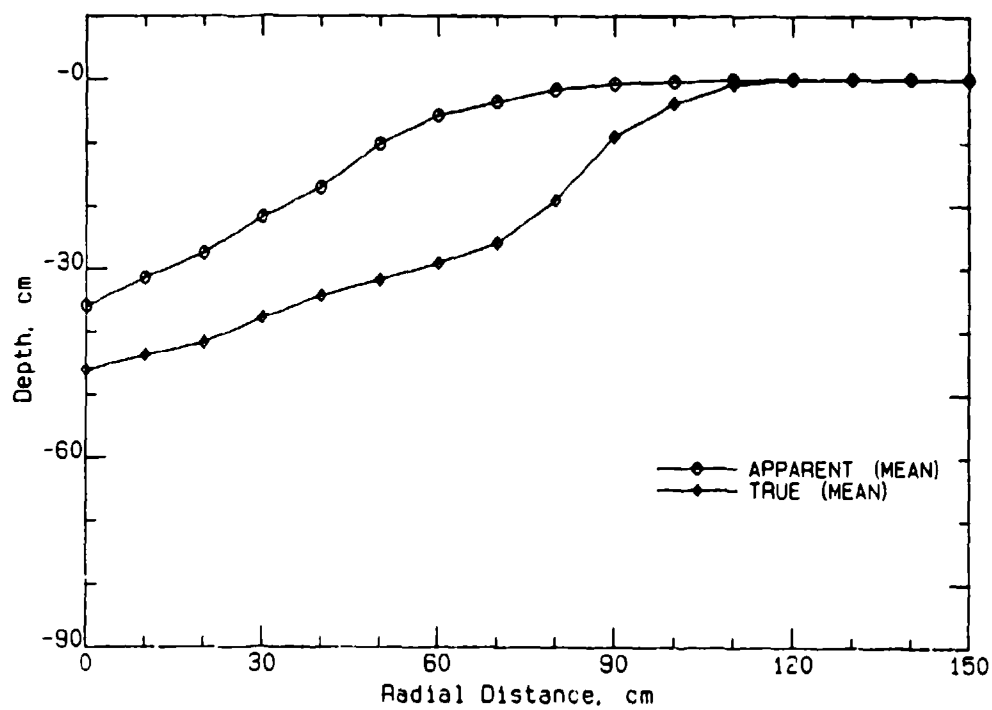


d. True volume, DOT II

Figure 16. (Concluded)

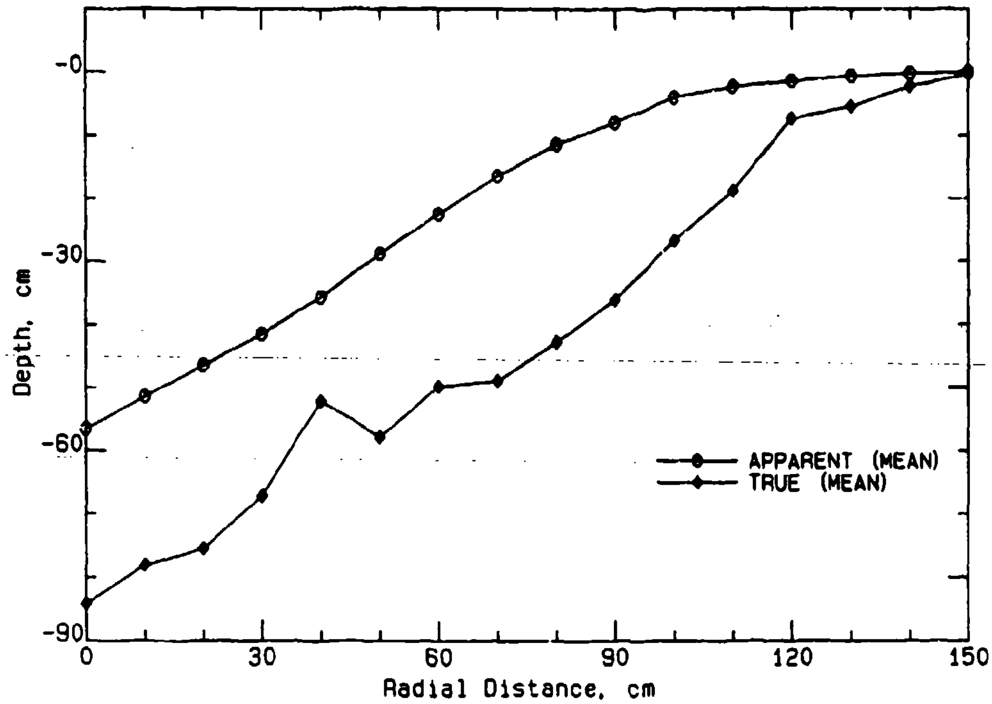


a. "A" shot (ST) profiles, DOT I

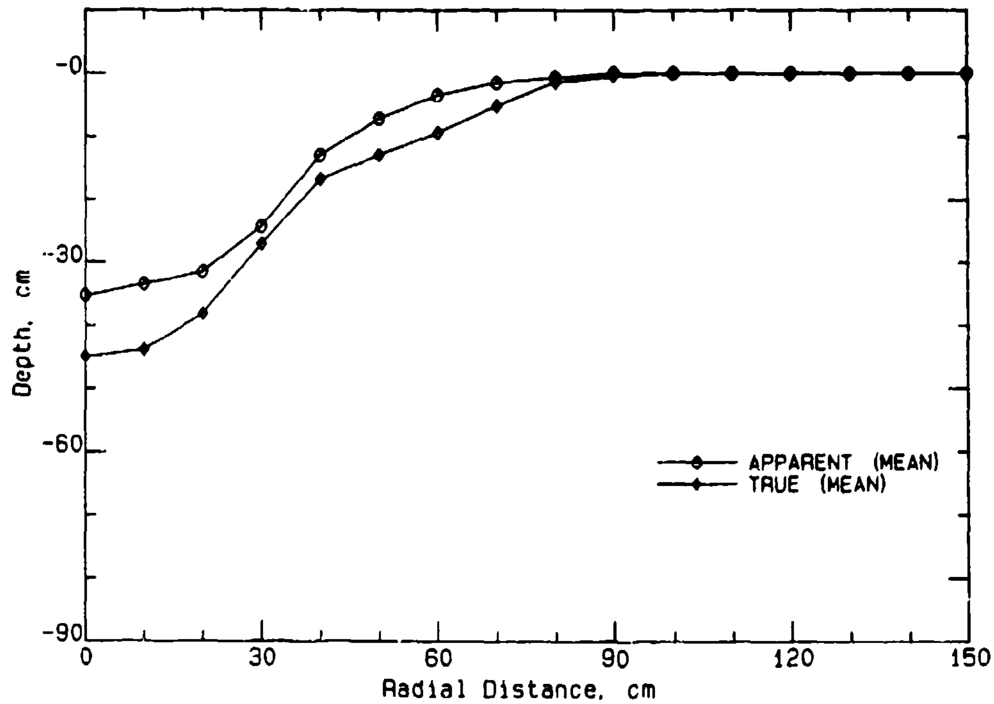


b. "B" shot (ST) profiles, DOT I

Figure 17. Mean (apparent and true) shot profiles (Sheet 1 of 3)

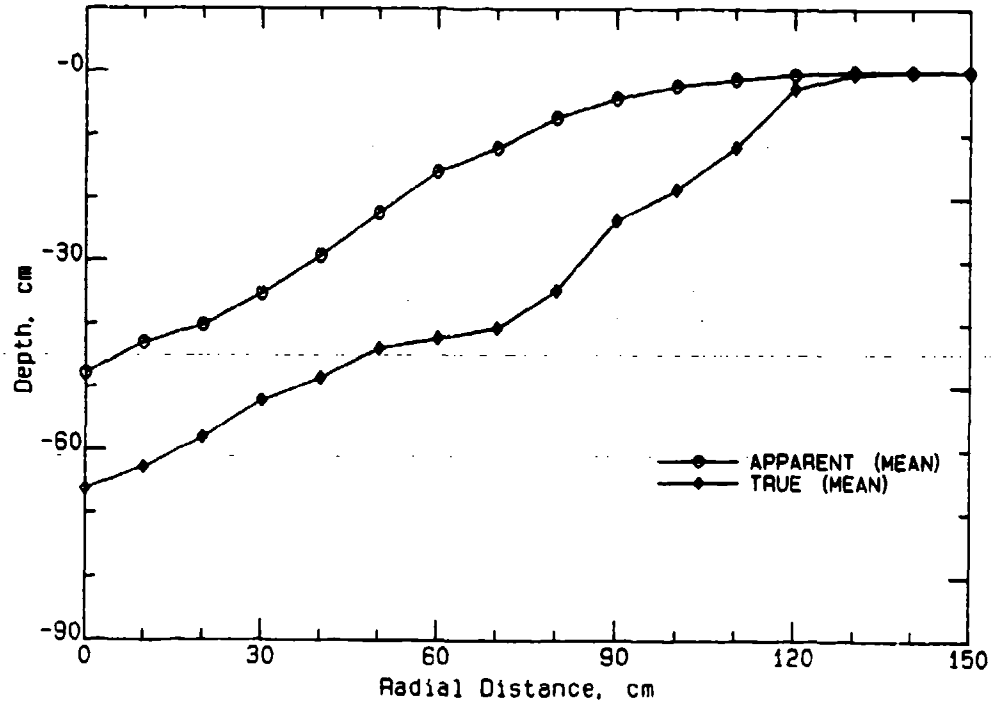


c. "B" shot (STB) profiles, DOT I

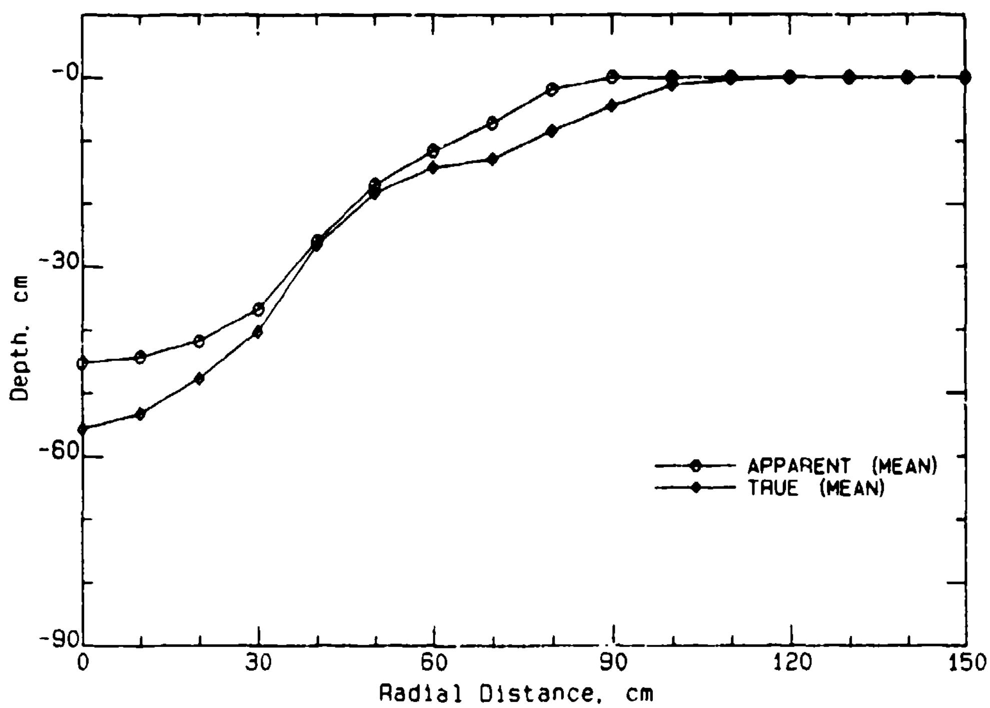


d. "B" shot (ST), DOT II

Figure 17. (Sheet 2 of 3)



e. "C" shot (ST) profiles, DOT I



f. "C" shot (ST) profiles, DOT II

Figure 17. (Sheet 3 of 3)

48. Comparison of the mean profiles for similar charge weights shows distinct differences in crater profiles between DOT I and DOT II, both in shape and resulting volumes. These differences are particularly striking for the true crater profiles, with the DOT I profiles showing a distinct "shelf" as opposed to the smooth profiles of DOT II. The volumes calculated from these mean profiles are given in Table 4 and are compared to the mean volumes found by averaging the individually determined volumes found in Table 3. Note that no significant differences are found in the mean values for the two methods. The effect of burying the charges (STB) on the crater volumes is also illustrated by the mean crater profiles, as the 15-lb STB shots typically created much larger craters than even the 25-lb ST shots.

49. Two factors that have been identified as likely contributors to the differences in the DOT I and DOT II craters are (a) the existence of a hardpan approximately 10 to 20 cm below the surface at the DOT I site and (b) the difference in soil densities between the two sites.

50. The hardpan layer at the DOT I site was noted by field workers as they encountered and broke through this layer while acquiring CI data. This region was relatively thin (several centimetres) as it cannot be identified in the CI data. The shelf seen in the DOT I crater profiles, particularly in the A shots, is undoubtedly a manifestation of the hardpan zone. The hardpan is also likely to be the cause for the greater than usual height obtained by the ST shots. The shape and height of the clouds generated by ST shots during DOT I resembled buried shot clouds seen in earlier high-explosive tests (e.g., DIRT [Dusty Infrared] tests).

51. The second difference between the two sites noted above was in soil density. Site 1 had a mean pre-shot surface soil density of approximately 1.4 g/cm^3 (1.22 g/cm^3 dry) while the DOT II mean site density was approximately 1.75 g/cm^3 (1.58 g/cm^3 dry). The soil moisture contents measured at the two sites were nearly the same, with values of 14 percent and 10 percent for Sites 1 and 2, respectively. The resulting voids ratios (the volume of voids divided by the volume of solids) for the two sites are calculated to be approximately 1.2 and 0.7.

52. Additional differences between the two sites include slightly different soil characteristics and surface soil grain sizes (see Figure 5).

53. Regardless of the causes for scatter in true crater volumes and differences in crater profiles, the relative consistency of the apparent crater volumes is encouraging, implying that for a given charge weight and set of site/soil properties, a predictable apparent crater volume will be formed. This leads to a simple calculation for the mass excavated by the explosions. By ignoring complicating effects such as soil compaction in the true crater, the excavated mass is computed by simply taking the product of the dry pre-shot soil density and the apparent crater volume. Table 5 displays the results of these calculations and shows that approximately equivalent amounts of mass have been ejected for similar charge weights in both DOT I and DOT II. An oversimplified physical argument would conclude that the energy available from a given charge will remove a well-defined amount of mass, given similar soil characteristics. Similar charges detonated in terrains quite different from the Fort Carson area may produce different results. Nevertheless, the Fort Carson study provides very important data for quantifying a charge weight-mass ejecta relationship.

54. The DOT crater data provide information for verifying charge weight/crater volume algorithms previously developed and currently used in various DoD models. A widely used algorithm is that of the EOSAEL 82 COMBIC module (Hoock et al. 1982) which is expressed as:

$$V = SW^{1.111}$$

where V is the crater volume, in cubic metres; S is a scaling factor, dimensionless, reflecting site variability; and W is equivalent weight of charge, in kilograms TNT. Figure 18 displays the mean apparent crater volumes from DOT as functions of charge weight in equivalent kilograms of TNT. The dashed line in Figure 18 represents the 1.111 power law used by the EOSAEL 82 COMBIC module. While the power law seems to describe the relationship quite well, the actual COMBIC predictions for the Fort Carson crater volumes are high. This is a result of the rather coarse grid offered by COMBIC for setting the scaling factor coefficient. Therefore, the future focus of the charge weight/crater volume studies should be directed toward refinement of the scaling factor.

55. Correlations between crater volumes and soil density or soil moisture content were not evident in the DOT data. This is a reflection of the similarity in soil types and grain sizes between Sites 1 and 2 and the rather narrow range of soil moisture contents. Figures 19 and 20 present the soil density and soil moisture content data from DOT as functions of the normalized apparent crater volumes, i.e., the apparent crater volumes divided by the charge weight. In the data collected in the DOT tests, at least, it is apparent that soil densities and range of moisture contents had negligible influence on crater volume.

Dust Clouds

56. The focal point of the DOT test was the characterization of the dust clouds in context of source generators and site/soil factors. Mass loading, cloud masses, cloud structure, and cloud optical properties have been studied from the acquired data. The following paragraphs present the dust cloud analysis for DOT I and DOT II.

Mass extinction coefficients

57. The mass extinction coefficients presented in Table 6 are courtesy of Dr. Donald Hoock, ASL, White Sands Missile Range. Hoock first identified those dust clouds which passed through the interior of the Hi-Vol sampler line 1 through 5 from video tapes. This ensured that a cloud profile could be determined with good confidence. Trials A7, A8, B4, B5, B6, B10, B13, and C4 were found to meet this requirement. Path integrated dosages (g · sec/m) were determined for these trials as well as integrals of the negative of the natural log of transmittance (at each wavelength band) over the time the transmittance was between 85 percent and 0.1 percent. The ratio of the transmittance integration to the dosage integration yields the mass extinction coefficient as presented in Table 6.

58. Hoock notes these coefficients will be somewhat underestimated if the dust is more concentrated at the 1.5-m level (Hi-Vol samplers) than at the 2.5-m level (transmissometer LOS) and somewhat overestimated if the converse is true. Details of these calculations will be found in the ASL final DOT report.* We also note that the presence of significant amounts of burn products (e.g., carbon) along the transmissometer LOS causes the coefficients to be overestimated. Unfortunately, no data concerning the amount and type of burn products mixed in the dust cloud exist.

*Personal Communication, 1984, D.W. Hoock, op. cit., p 24.

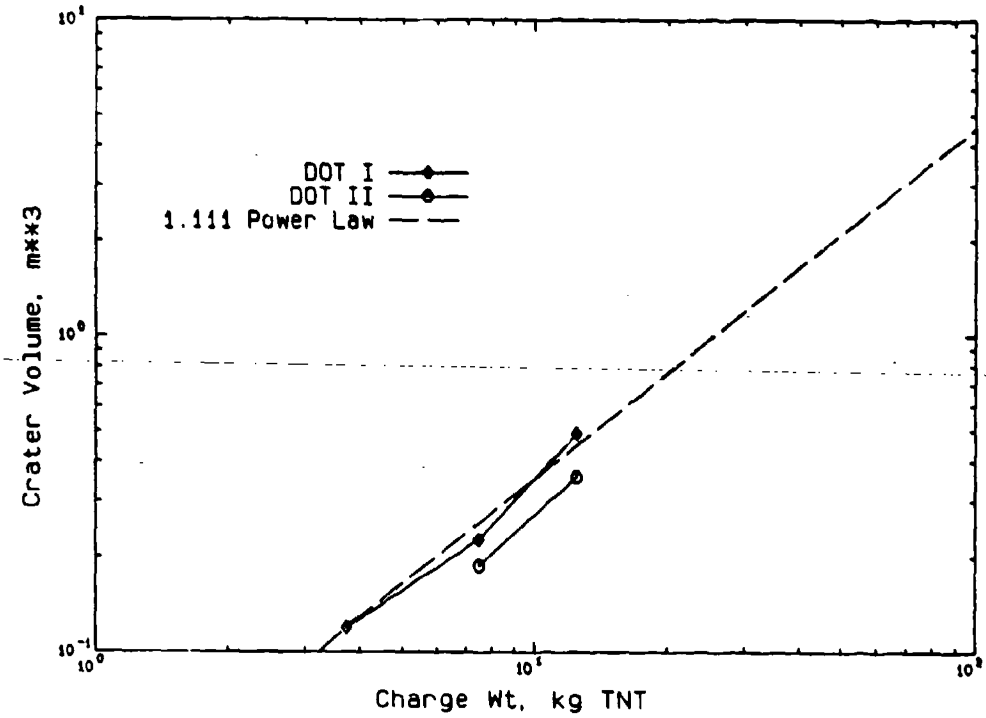


Figure 18. Mean apparent crater volumes as a function of charge weight

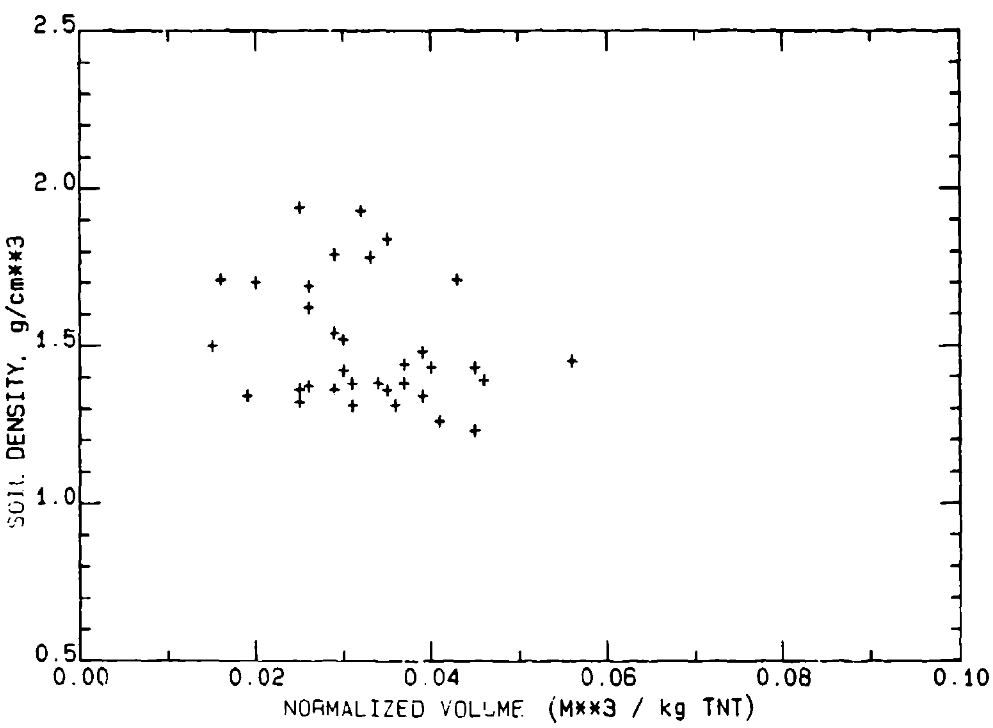


Figure 19. Soil density compared to normalized crater volume

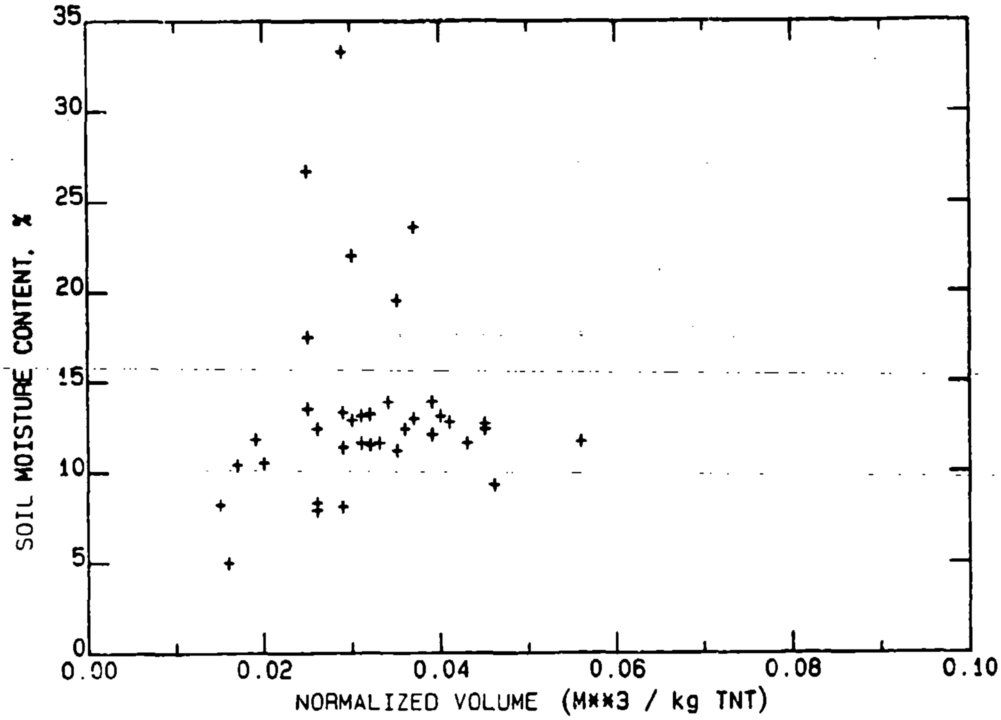


Figure 20. Soil moisture content compared to normalized crater volume

Dust cloud masses

59. The determination of accurate dust cloud masses has been proven to be difficult and inexact in past tests. Consequently, a new strategy was formulated for evaluating the DOT-generated clouds (see Hoock and Kennedy 1983). Much of the measuring difficulty lies in the individuality of each cloud, both in structure and dynamics. Although general geometries, structure, and dynamics exist, the effects of micrometeorology, local perturbations in terrain and soil, and any existing peculiarities of explosive charges all contribute to the uniqueness in detail of individual clouds. (A survey of the video tapes reveals the extent of this problem.) Thus, a rather large scatter in mass determinations was expected, making different and independent calculations highly desirable.

60. The cloud masses presented in this report are independent calculations provided by Dr. Don Hoock and Dr. Charles Bruce et al. for the DOT I data and by PEDCo Environmental, Inc., for DOT II. Although cursory comments outlining the different mass calculation approaches are made here, reference is made to the appropriate final reports (Bruce, Unthank, and Jelinek 1985; Hoock*; PEDCo Environmental, Inc. 1985) for complete descriptions of the computations.

61. Hoock's approach for calculating cloud masses utilizes the transmissometer data by computing the total mass of dust in a 1-m-thick layer at 2.5 m above the ground (the transmissometer LOS).

*Personal Communication, D.W. Hoock, ibid.

The working equation for computing this layer mass is given by

$$\frac{dm}{dz}_{2.5} = \frac{-v_r \int_0^t \ln T(\lambda)\, dt}{\alpha(\lambda)}$$

where

$\frac{dm}{dz}$ = rate of change of mass, g, with height, m
v_r = speed of cloud perpendicular to the LOS, m/sec
$T(\lambda)$ = transmittance (0 to 1) at wavelength λ
t = duration of test, sec
$\alpha(\lambda)$ = mass extinction at wavelength λ, m^2/g (see Table 6)

62. The perpendicular velocity was determined both from the meteorological data as well as from the time it took for the dust to reach the transmissometer LOS and the perpendicular distance from the detonation point to the LOS. As those velocities were always different, giving two values of *dm/dz* for each shot, the average value was computed. The final step in the calculations involves the assumption that for well-defined cloud shapes the mass loading was constant with height. Then, from the heights of the clouds measured from the video tapes, masses were calculated from

$$M = (dm/dz)\, Z$$

where

M = mass, g
dm/dz = rate of change of mass, g, with height, m
Z = height of the cloud, m

63. Several caveats to this approach are noted. First, the assumption of the mass loading consistency with height is only a working approximation. The vertical samplers do not support this assumption for individual clouds but indicate a variety of distribution profiles. Second, the cloud heights used were measured from the surface to the top of the visible clouds. There is currently supporting evidence from the vertical samplers that dust does not exist in significant amounts to the heights indicated by the visible cloud tops. The upper cloud regions are black for most shots, as opposed to the brownish lower portions of the clouds. This suggests that most of the upper part of the clouds may be burn products of the munition and contains little dust. The question of height of the dust in the cloud is reconsidered below.

64. The Bruce calculations are somewhat more involved than the previously described Hoock method and have required a number of assumptions and approximations in reducing the data. Therefore, the reader should refer to the Bruce, Unthank, and Jelinek (1985) final DOT report for details of the cloud mass calculations, as the analysis will be only briefly discussed here.

65. The principal data required by Bruce are the Hi-Vol sampler and nephelometer data that have been used to map density profiles of the dust clouds in both the horizontal (at 1.5 m) and vertical planes. From the video tape as well as the sampler array information, only those clouds which passed through the sampler arrays (vertical and horizontal) and maintained manageable geometry were selected for analysis. The dosage (and density) profiles as provided by the horizontal

samplers suggest a Gaussian distribution in the clouds. Thus, the following distribution function was adapted:

$$\varrho_{1.5}(r) = \varrho_{1.5}(0) \exp(-r/r_0)^2$$

where

$\varrho_{1.5}(r)$ = density in the horizontal plane at 1.5 m and at a distance r from maximum density, g/m^3
$\varrho_{1.5}(0)$ = maximum density in the 1.5-m horizontal plane, g/m^3
r = distance from point of maximum concentration, m
r_0 = distance at which the density is e^{-1} of the maximum density, m

66. While the vertical profiles were neither consistent nor easily characterized, heights which significant amounts of dust reached were determined with a straightforward extrapolation of the implied profiles. The heights obtained in this manner gave quite repeatable results and, in general, strongly suggest that the maximum altitude acquired by significant dust is generally much lower than the visible top of the clouds (see Table 7).

67. Two algorithms were selected in calculating the cloud masses, both of which assumed circular cylindrical symmetry. The first, termed the rectangular method, is given by

$$M = \pi r_0^2 Z \varrho_{1.5}(0)$$

where

M = total mass of the cloud, g
Z = height of dust in cloud, m

68. This approach assumes every horizontal slice has exactly the same central (maximum) density as the 1.5-m slice. This approach was formulated for comparison with the cloud masses determined by the Hoock method and ignores the vertical structure of the clouds. The vertical samplers, however, indicate that the maximum concentration is a function of height. This function is apparently highly variable and must be formulated for each cloud.

69. The second Bruce algorithm attempts to account for the functional height dependence and is written:

$$M = \int \varrho(r,\theta,r)\, r dr d\theta dZ$$

or

$$M = \pi \varrho_{\varrho\varrho} r_0^2 \int_0 F(z) dz$$

where

$\varrho_{\varrho\varrho}$ = peak concentration in the cloud, g/m^3
$F(z)$ = functional form of the vertical concentration profile from graphical fit

70. The peak concentration $\varrho_{\varrho\varrho}$ was calculated from the ratios of the peak vertical and horizontal dosages as determined from the profile fits multiplied by the maximum concentration at 1.5 m. This is expressed as

$$\varrho_{\varrho\varrho} = \varrho_{1.5}(0)(D_v/D_{1.5})_{max}$$

The dust particle masses determined by this algorithm are similar but, in general, slightly smaller than by the rectangular algorithms.

71. The PEDCo Environmental, Inc., calculations are similar to the second Bruce algorithm. Both horizontal and vertical concentration profiles are used to integrate over the cloud volumes. Unlike DOT I, a number of cloud masses were determined for multiple-shot trials. These multiple-shot cases are not used in the comparisons made below.

72. Table 8 compares the results of the mass calculations made for DOT I and DOT II. While mass means from the Bruce and PEDCo Environmental determinations seem to agree, the Hoock mass means are almost a factor of four larger. If Hoock's masses are recalculated using the cloud heights suggested by the vertical samplers instead of the visible cloud tops (see Table 7), the Hoock masses are reduced by approximately 40 percent. These recalculated masses are listed as "modified Hoock" masses in Table 8. (Unfortunately, no A shot clouds tracked through the vertical sampling tower, so no vertical profile data are available.) However, if a 40-percent reduction for the A shot clouds is used, the resultant mass falls in nicely with the B and C shot modified values.

73. An important question to be answered in the high-explosive phase of DOT concerns the amount of mass that remains lofted relative to the mass excavated by the crater generation. Results from Tables 5 and 9 provide an answer to this question. By using mean values from excavated masses and cloud masses, values of approximately 2 percent are easily derived for the percentage of excavated mass remaining in sustained clouds (Table 10). Even if the larger cloud mass estimates in Table 9 are assumed (instead of the means), the percentages remain smaller than 5 percent. While these results are quite significant, it should be emphasized that the DOT results really provide only one data point in the charge weight-soil/terrain-crater volume-cloud mass relationship as these values are valid only for bare ST charges and a rather narrow range of soil and moisture conditions. Near-surface buried charges create larger craters and are suspected to result in more massive dust clouds. Since only one STB dust cloud was adequately sampled for mass determination, the DOT test provides no statistics for cloud masses from buried shots.

74. Figure 21 is a plot of the excavation and cloud mass means given in Tables 5 and 9 for all the techniques discussed for the ST trials. The Bruce means for the B shots *do not* include B15, as it was a buried shot, nor B7, as it appears extremely anomalous. All values have been rounded to the nearest hundred grams.

75. A final note should be made concerning cloud ages at sampling time. The cloud ages at the sampling arrays ranged between 6 and 20 sec. No correlation between cloud mass and cloud age in these data has been detected, implying that cloud masses in this age range do not change significantly and/or the errors in the cloud mass estimates overwhelm changes in mass for this rather narrow time interval. It does seem logical that cloud mass will be a function of cloud age as settling and scavenging occur, at least until the cloud reaches a quasi-stable state. However, a much wider range in ages than those observed at the DOT test is needed for confirming this reasoning and to establish decay rates.

Cloud heights

76. The clouds produced by the ST DOT test shots appeared, in general, to be more representative of STB shots because of the relatively large heights attained. It is proposed that this phenomenon may have been caused by the hard subsurface layer found throughout the test site. This fact should be remembered when comparing cloud heights of this test with those of other high-explosive test clouds.

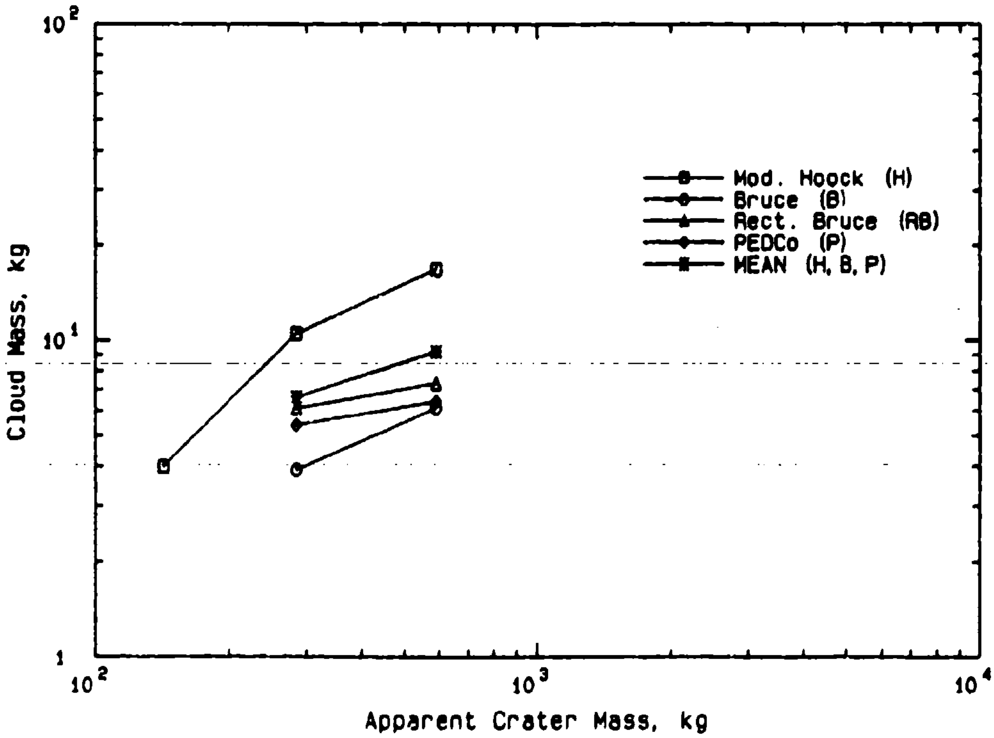


Figure 21. Estimated cloud masses (by four different methods) compared to their respective apparent crater volumes

77. The cloud heights presented in Table 7 are measured in two ways. The first is from the Hoock cloud mass analysis in which the visible tops of the clouds were measured from the video tapes. The second is from the vertical sampler data. Striking consistency is apparent in the means of both sets of measurements. The visible cloud top means measured from the video are very nearly equal for all three groups of explosive charges, with a value of approximately 30 m. However, the scatter among individual measures is quite large. In contrast, the vertical samplers imply very repeatable but charge-dependent heights for the dust in the clouds, giving mean heights of 14.5 and 18.5 m for the B and C shots, respectively. It is likely the difference in the heights between the video-visible and sampler measurements is due to the fact that the upper portions of the clouds are buoyant, i.e., mainly hot gases and burn products that contain little dust. This conjecture draws some support from the strong color difference seen between the upper and lower portions of the cloud, but whether a significant amount of dust is entrained by the upper cloud is uncertain.

Radii and widths

78. The DOT dust clouds have been characterized in this analysis by defining widths in two different manners. The first characterization defines an e^{-1} density radius r_0 and assumes a Gaussian density distribution. The second characterization defines obscuration widths based on obscuration times below 50-, 37-, 10- and 2-percent transmission levels.

79. The first manner of characterizing the cloud radii by r_0 has been approached with two independent sets of calculations. One set has been determined by Bruce using the Hi-Vol density profiles. By assuming a Gaussian distribution to the observed profiles, e^{-1} radii are easily measured.

These radii are then corrected for wind angle relative to the sampler array. These radii have been used by Bruce in calculating cloud masses. The second set of e^{-1} radii have been calculated using the transmissometer data as described below.

80. Assume, as before, that the dust clouds are circular symmetric in the horizontal plane and have a Gaussian distribution in density. Then, as the clouds drift through the transmissometer LOS, a minimum transmittance will occur when the LOS cuts through the cloud center. Using the Beer-Lambert law at the minimum transmittance and assuming the entire cloud lies between the transmitter and receiver yields

$$ln\ T\lambda = -\alpha\lambda \int_{-\infty}^{\infty} \varrho_{2.5}(0)\, e^{-(r/r_0)^2}\, dr$$

where

$T\lambda$ = minimum transmittance at wavelength λ
α_λ = mass extinction coefficient for wavelength λ, m^2/g
$\varrho_{2.5}(0)$ = peak concentration at the 2.5-m level, g/m^3

Integrating and solving for r_0 gives

$$r_0 = \frac{-\,ln\ T_\lambda}{\sqrt{\pi}\ \alpha_\lambda\ \varrho_{2.5}(0)}$$

81. Problems arise once the minimum detectable transmittance threshold has been reached. For the DOT test, this limit is less than 0.1 percent transmission. Using 0.1 percent if values smaller have been recorded causes r_0 to be underestimated. This is not a major problem, as threshold values, when they occur, are usually observed for very short time intervals (1-2 sec) and rarely occur in all four wavelength bands. Furthermore, factor of 10 lower than threshold, 0.01 percent, results only in a factor of 2.3 in r_0 estimates.

82. Minimum values of transmittance did not always occur simultaneously in the data for all four wavelengths. However, since the minima were usually within 1 or 2 sec of each other, only minimum transmittance data were used for the calculations.

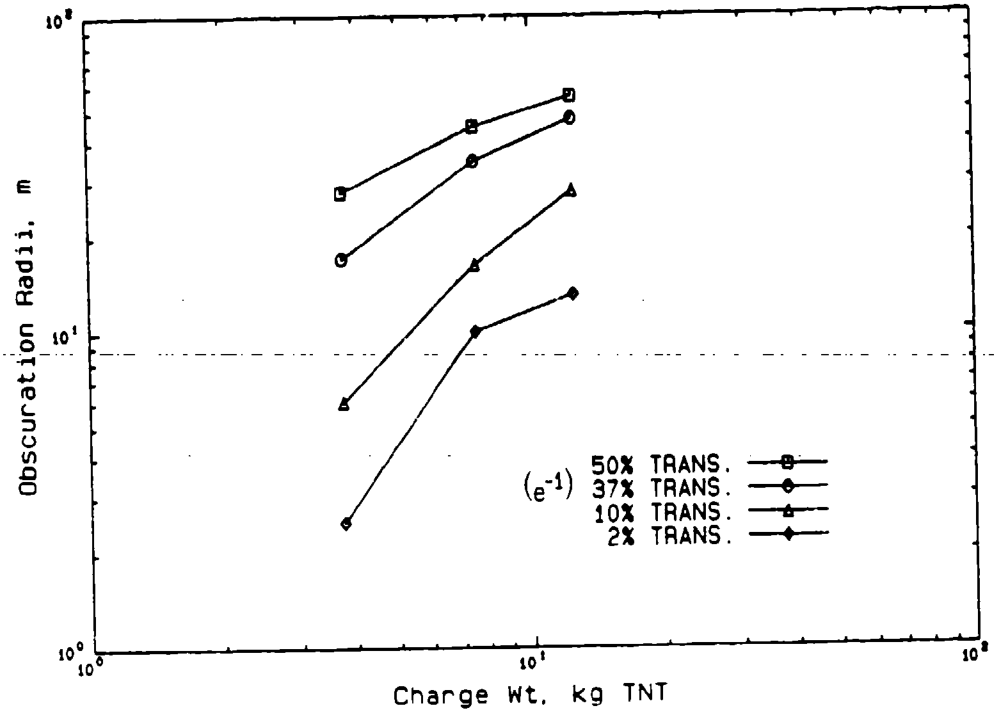
83. The mass extinction coefficients used were those of Hoock (Table 6). The peak densities at 2.5 m were calculated from the peak densities given by Bruce at 1.5 m and the vertical sampler profiles.

84. The results of these radii calculations, along with those values determined by Bruce, are given in Table 11. Although the B shot means agree quite closely, the C shot means are obviously in disagreement. The transmission radii at 2.5 m are in general expected to be somewhat larger as the vertical profiles often indicate a density increase from the surface to above the transmissometer LOS at 2.5 m. Recall that the Bruce radii were measured from the Hi-Vol profiles at 1.5 m. While the accuracy of each method is difficult to assess, the results are not so grossly different as to prohibit reasonable estimates of r_0 for mean dust clouds.

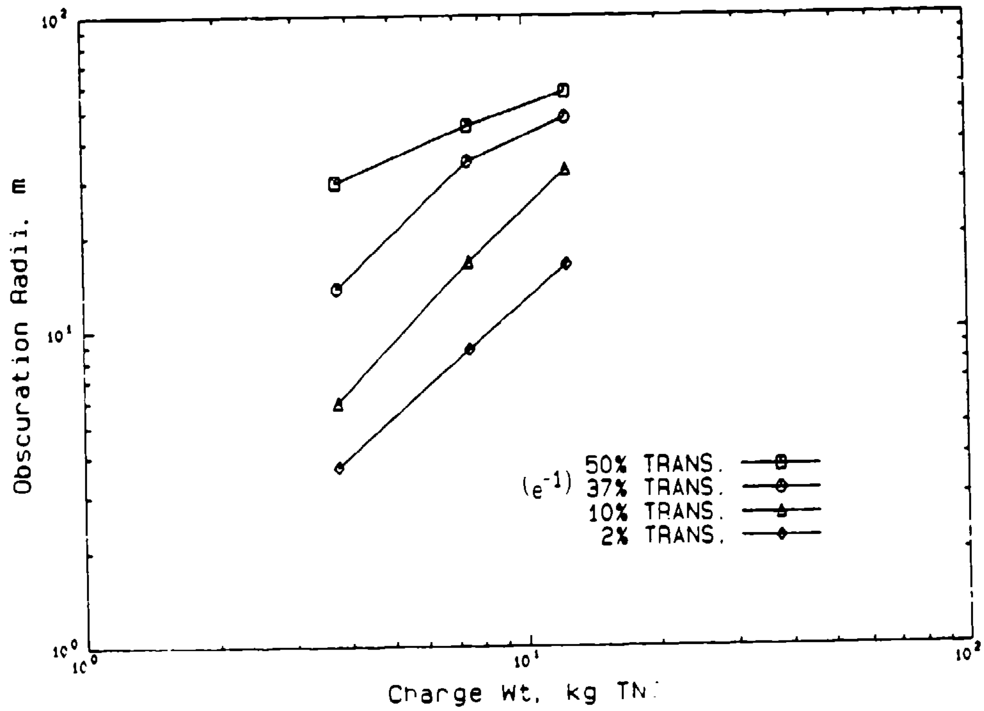
85. The second width characterization of the dust clouds is that of obscuring widths for the four transmissometer wavelength bands at thresholds of 50, 37, 10, and 2 percent transmittance. The method here has been to find the total time for a given threshold and wavelength band that the transmittance was below the threshold value (see Appendix A for histogram data). Then, from the meteorological data, the wind speed component perpendicular, V_Q, to the transmissometer LOS was calculated and multiplied by the total obscuration time to yield the obscuration width.

Tables 12-15 display the results of this analysis. (Divide the widths in Tables 12-15 by 2 to obtain obscuration radii.) Figures 22a-d present the results of these calculations. Note that only slight changes are seen in the obscuration widths between the visible and the infrared. This is expected due to the similarity in mass extinction coefficients for the four bandpasses (see Table 6).

86. It is interesting to note that the Pasquill Stability Category shows no correlation with the calculated radii. Thus, it is proposed that through the early life of clouds, the internal turbulence created by the blast completely overwhelms the surrounding atmospheric turbulence, and not until this explosive turbulent energy is dispersed will the standard atmospheric diffusion processes become dominant. The age of the clouds passing through the transmissometer LOS ran from 6 to 20 sec. A study of the video tapes suggests a significant amount of turbulent blast energy apparently remains in the clouds through this time frame, thereby supporting the above conjecture.

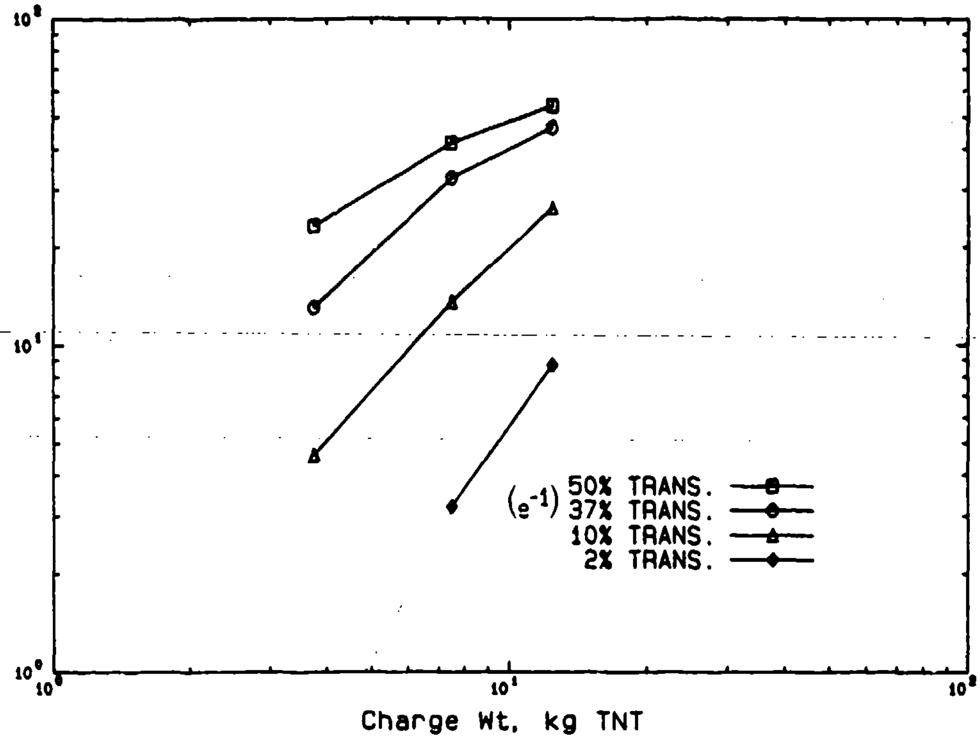


a. Visible

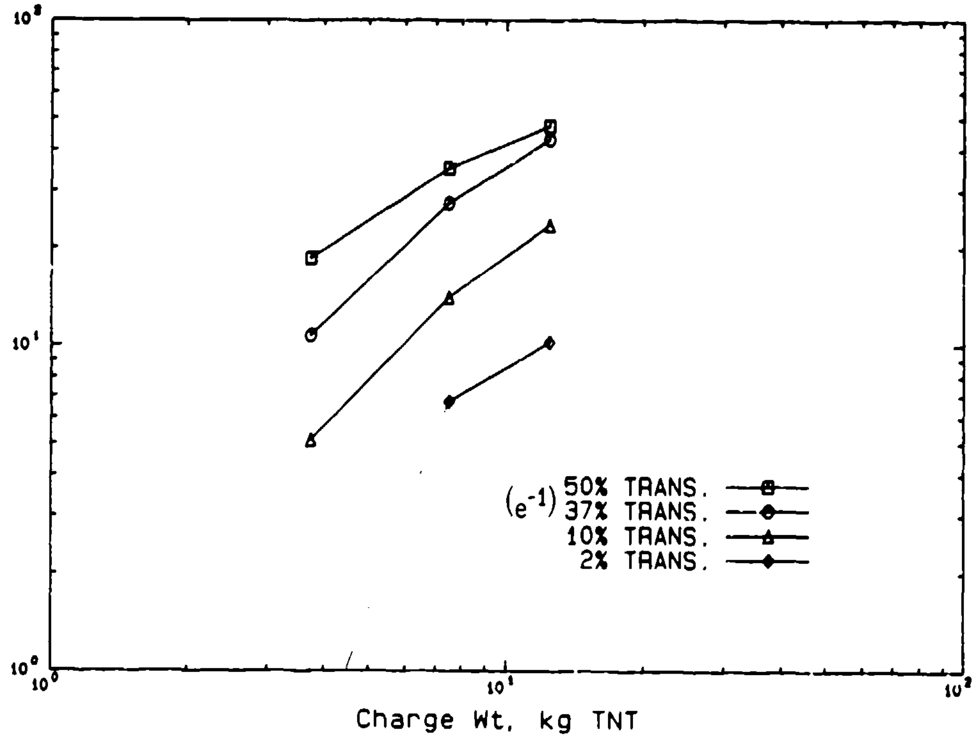


b. 1.06 μm

Figure 22. Obscuration radii for various wavelength bands compared to charge weight (Continued)



c. 3.8 μm



d. 8.4-12 μm

Figure 22. (Concluded)

PART V: CONCLUSIONS AND RECOMMENDATIONS

87. The DOT tests have proved successful in establishing a number of important relationships concerning dust cloud production by high explosives. The DOT tests have also provided quantitative characterization of these dust clouds which includes physical properties and obscurant potentials in four different spectral bands. The results of the DOT I and II tests are summarized below.

Determination and Measurement of Relevant Factors

88. One of the most important results to come out of this study is the relationship established between crater volume and dust cloud mass. From the analysis presented in Part IV, it has been determined that approximately 2 percent of the mass excavated from a crater by a ST detonation remains lofted in a young cloud. This result is also linked to the initial charge weight of the explosive through the charge weight-crater volume power law relationship (see Part IV, paragraph 54). Therefore, given a charge weight and terrain/soil parameters similar to those found at Fort Carson, a reasonably accurate prediction of cloud dust mass can be made. The apparent relationship between charge weight and excavated mass, regardless of soil moisture, density, and type, is also an important result of DOT. This relationship certainly warrants more study given the narrow range of terrain/soil parameters occurring at the test sites.

89. Dust cloud physical properties determined from the DOT data include visual heights, dust heights, cloud widths (both dust density and obscuring widths), and mass extinction coefficients. The mean visual heights, which include the buoyant upper portion of the cloud, have been determined to be approximately 30 m for all three charge weights used, but there is a large scatter about these means. However, the mean heights at which the measurable dust is lofted in these young clouds have been determined from the vertical Gelman samplers to be 14.5 and 18.4 m for the 15- and 25-lb shots, respectively (refer to Table 7 for the cloud height statistics). The cloud widths as defined by dust concentration profiles have been determined using the Hi-Vol samplers and also by the transmissometer observations. These density widths are calculated to be approximately 15 and 25 m for the 15- and 25-lb shots, respectively (see Table 11). These widths are comparable to the values of 16- and 28-m determined visible obscuration widths (corrected for wind speed and direction) of 10 percent or less transmission (see Tables 12-15.) Furthermore, the analysis reveals the transmission obscuration width of a dust cloud remains nearly constant in the four bandpasses observed at the DOT. This is a reflection of the small change in mass extinction coefficients with wavelength observed in the clouds, ranging from 0.18 m^2/g in the visible to 0.12 m^2/g in the 8.4- to 12-μm bandpass. (Refer to Table 6.) Future test characterization should be pursued in terrains/soils different from those at Fort Carson in order to identify the major relationships between cloud properties, charge weight, and terrain environmental parameters.

90. Observations of the clouds as they passed through the sampling arrays indicate the clouds were still dissipating turbulent energy generated by the detonation. These observations are supported by the lack of correlation between Pasquill Stability Category and cloud widths as measured at the samplers.

91. The dust clouds generated at Fort Carson displayed distinct color separations. Typically the upper, buoyant portions tended to be dark or black, indicating burn products, while the lower portions tended to be brownish, indicating a preponderance of dust. Outer regions of the lower portions of the clouds were often whitish, perhaps remnants of shock-induced dust or dust of smaller particle sizes.

92. Moisture content was not sufficiently varied at the two sites to provide meaningful correlations with dust masses, and even soil properties proved to be more similar than originally expected on the basis of initial field inspections. Grain sizes and percentage of fines proved not to vary significantly between the two test sites.

Dust cloud mass determination

93. The difficulty of determining the mass of dust lofted in a cloud created by explosion necessitated extensive and redundant sampling. In spite of the elaborate sampling design used for the DOT tests, only about one-half of the events attempted yielded a data set complete enough for analysis by the various mass calculation algorithms. This fact reflects the short-term variability in wind direction, which often foiled attempts to place the explosive charges in locations such that the wind would carry the dust clouds across the sampler array. However, incomplete data sets are not without merit, as they provide crater data and video data used to measure cloud sizes and qualitative information on cloud dynamics. Often these incomplete data sets will also contain transmissometer data or dust density profile data in one dimension. Therefore, it has been concluded the sampler array approach coupled with real-time monitoring of wind conditions is a satisfactory approach to the young dust cloud sampling problem. The mobile multiple-tethered balloon approach used in DOT II allows a statistically higher degree of success in measuring vertical profiles than the single-tower approach used in DOT I.

Charge size effects

94. The DOT tests have substantiated the findings of previous workers explaining the relationship between charge size and crater volume (the 1.111 power law). Unfortunately, the relationship among charge, crater sizes, and amount of dust lofted has not been thoroughly investigated, largely because reliable sampling of dust clouds is so difficult. Furthermore, the influence of specific terrain factors such as soil moisture content, soil density, and soil type is not complete, lacking sufficient range for correlations to be recognized in the DOT data. This fact is also true of previous tests of this nature and is reflected in the rather crude terrain effects scaling factor used by COMBIC (EOSAEL 82) for the charge weight-crater volume algorithm (paragraph 54).

Recommendations for Future Studies

Instrumentation

95. Instrumentation that is interdependent in the sense of data analysis should be collocated. In the DOT trials, significant cloud inhomogeneities were noted to exist over distances as short as 1 m. (The clouds are clumpy.) Therefore, if test analysis requires the linking of data from two instruments for spatial information, e.g., nephelometer and Hi-Vol data, the instruments should be placed as close together as possible. Instrument size and volume of influence will, of course, dictate the limits of collocation.

Charge size

96. The DOT results confirm the data produced for previous field tests concerning the charge weight-crater volume relationship. Because this relationship is apparently well established and because secondary influences are only partially understood, we recommend future test designers

consider holding the driver (charge and shot configuration) constant while varying the secondary parameter. Preferably, the test should be designed to hold all parameters constant except for the variable studied.

Extension of event sampling time

97. In terms of cloud characterization, future test efforts should address the problem of cloud evolution. The clouds measured at the DOT exercises were approximately 10 sec old, still dispersing a significant amount of turbulent energy and containing many large nonbuoyant particles. A question that must be answered concerns the amount of mass and the particle size distribution of the clouds after the turbulent energy has dissipated and the large particles have settled. It is the older, quasi-stable clouds that may ultimately affect battlefield performance during sustained engagements.

98. Measurement of the quasi-stable cloud presents a difficult challenge to the field tester. The unpredictability of cloud trajectories makes adequate sampling of the clouds by stationary instrumentation either haphazard or prohibitively expensive. Remote sensing techniques probably offer the best solution to this problem but must be demonstrated to be valid or at least consistent with sampling instrumentation. Thus, remote sensing techniques should be validated by stationary sampling instrumentation in a few tests with physical layouts much like those used in the DOT.

Optical properties of cloud components

99. Because of a real need to understand the optical properties of the explosively generated dust clouds, quantitative measurements of both the amount and spatial distribution of burn products must be made in future tests. Strong color differences seen in the clouds produced in the DOT as well as the vertical mass measurements indicate the majority of the dust is in the lower portion of the clouds while much of the hot burn products are in the buoyant upper portion. However, significant amounts of burn products in the lower portion will strongly affect the transmissometer data and lead to calculations of erroneous extinction coefficients for the dust. These results will definitely affect the ability of most remote sensing techniques to determine accurate cloud masses.

100. The effects of vegetation characteristics, which have generally been excluded, may warrant more careful consideration. Future tests should provide more detailed characterization and measurement of vegetation type, density, and coverage.

Environmental parameters

101. We need to know much more precisely how soil moisture contributes to dust loading. Such a test should be conducted in an area where the soil structure (density, composition, percent fines, etc.) and vegetation cover are reasonably constant over the site and the charge weight and configuration (e.g., surface tangent or buried) remain unchanged from shot to shot. The moisture content could be varied artificially, and a statistically significant number of shots should be conducted. The results of these tests would provide very important results concerning dust potential for a terrain/soil. The range of moisture contents covered by DOT suggests there are quite likely saturation values of moisture for a given soil which, when reached, will dramatically alter the dust potential. If these thresholds can be established, the field commander may no longer require precise soil moisture content analysis for estimating dust potential, but may be able to use

rather crude and/or simple measurement techniques. Certainly, different soil types are expected to yield different threshold values, so the soil moisture experiments must be conducted at a variety of sites. Defining the environmental parameters could lead to a refinement of the scaling factor used in the EOSAEL 82 COMBIC model to predict crater volumes produced by a certain charge weight.

Summary

102. The lesson learned from the Fort Carson, Colo., DOT exercises is that quantifying cloud masses generated by an explosive charge is possible, though difficult. Larger sampler arrays extended over greater distances along the cloud path would yield information unattainable and difficult to estimate using present techniques. Moreover, sampling older clouds would permit identification of the time at which forces of the blast become negligible when compared to "natural" atmospheric turbulence. At this point, existing atmospheric models could be employed to predict cloud behavior and content, and the precision of their predictions could be determined.

REFERENCES

Bruce, C.W., Unthank, J., and Jelinek, A.V. 1985. "Explosion and Vehicular Dust Profiles" in progress, US Army Atmospheric Sciences Laboratory, White Sands Missile Range, N. Mex.

Deepak, Adarsh. 1983. "Implementation of AirLand Battlefield Environment (ALBE) Products into Army Operations; Phase I: Current Operational Support," STC Technical Report 2018, prepared by Science and Technology Corp., Hampton, Va., for Office, Chief of Engineers, US Army, Washington, DC.

Hanna, S.R., Briggs, G.A., and Hosker, R.P., Jr. 1982. "Handbook on Atmospheric Diffusion," J.S. Smith, ed., prepared by National Oceanic and Atmospheric Administration, Atmospheric Turbulence and Diffusion Laboratory, Oak Ridge, Tenn., for Office of Health and Environmental Research, US Department of Energy.

Hoock, D.W., et al. 1982. "Combined Obscuration Model for Battlefield Induced Contaminants," Chap. 1, *Transmission Through Battlefield Aerosols,* ASL-TR-0122, Vol III, L.D. Duncan et al., eds., US Army Atmospheric Sciences Laboratory, White Sands Missile Range, N. Mex.

Hoock, D.W., and Kennedy, B.W. 1983. "Dust Obscuration Test (DOT): A Preliminary Project Survey, August 1983" (unpublished), US Army Atmospheric Sciences Laboratory, White Sands Missile Range, N. Mex.

Kennedy, B.W., compiler. 1982 (Jul). "Dusty Infrared Test III (DIRT III)," US Army Atmospheric Sciences Laboratory, White Sands Missile Range, N. Mex.

Long, K.S., et al. 1985. "The Dust Obscuration Test (DOT): Analysis of the High-Explosive Phase," p 149, *Battlefield Dust Environment, Symposium II: Proceedings,* K.S. Long and A. Deepak, eds., US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Mason, J.B., and Long, K.S. 1981. "Site Characterization for the MBCE/DIRT II Battlefield Environment Tests," Miscellaneous Paper EL-81-8, US Army Engineer Waterways Experiment Station, Vickburg, Miss.

__________. 1983 (Sep). "Site Characterization and Debris Measurement in the Joint Munitions Dust Test Series at Fort Polk, Louisiana," Miscellaneous Paper EL-83-4, US Army Engineer Waterways Experiment Station, Vickburg, Miss.

PEDCo Environmental, Inc. 1985. "Fugitive Dust Sampling of Military Vehicles and Explosives at Fort Carson, Colorado," Micellaneous Paper in preparation, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Table 1
High-Explosive Trial Log, DOT I

Trial*	Date (1983)	Charge Configuration	Detonation Coordinates, m X	Detonation Coordinates, m Y	Wind m/sec	Wind deg	Pasquill Category	Crater Profile
A1	4-19	BL,ST	0.0	94.5	5.4	230	B	Y
A2	4-19	BL,ST	2.4	78.9	5.9	259	B	Y
A3	4-19	S,ST	-6.1	106.1	8.2	278	D	Y
A4	4-20	S,ST	78.1	65.1	3.3	94	B	Y
A5	4-20	S,ST	77.7	9.0	2.3	128	A	Y
A6	4-22	S,ST	69.7	66.8	6.3	32	D	Y
A7	4-25	S,ST	7.7	75.2	5.7	290	C	Y
A8	4-25	S,ST	0.9	63.5	3.1	112	A	Y
A9	4-25	S,ST	30.7	20.9	2.6	156	A	Y
B1	4-20	S,ST	66.3	5.2	3.0	136	A	Y
B2	4-20	S,ST	50.4	4.5	3.0	129	B	Y
B3	4-21	S,ST	-16.0	78.4	6.7	267	C	Y
B4	4-21	S,ST	-14.9	88.8	6.8	283	C	ND
B5	4-21	S,ST	37.9	18.5	0.9	100	D	Y
B6	4-22	ND,ST	61.7	72.7	6.2	33	D	Y
B7	4-22	S,ST	80.9	69.1	8.8	30	D	ND
B8	4-23	S,ST	53.3	18.3	4.0	114	B	Y
B9	4-23	S,ST	88.9	-0.6	3.6	95	C	Y
B10	4-26	S,ST	43.5	17.8	5.6	117	B	Y
B11	4-26	BL,ST	39.1	9.4	5.1	136	C	Y
B12	4-26	BL,STB	65.0	-11.4	4.4	131	B	Y
B13	4-26	BL,STB	51.4	-11.5	5.1	125	B	Y
B14	4-26	BL,AGL	60.5	9.8	5.7	146	B	N
B15	4-26	BL,STB	36.1	2.8	5.8	155	C	Y
B16	4-26	BL(3),ST**	44.0	10.0	3.0	145	C	N
			54.8	9.4				
			65.9	9.2				
C1	4-20	S,ST	57.0	14.3	2.8	109	D	Y
C2	4-21	BL,ST	81.7	97.7	4.4	56	B	Y
C3	4-21	BL,ST	80.6	42.1	5.9	70	D	Y
C4	4-22	BL,ST	65.7	79.3	7.0	25	D	N
C5	4-22	BL,ST	90.6	71.0	8.8	52	C	ND
C6	4-23	BL,ST	29.8	5.6	3.5	157	B	Y
C7	4-23	BL,ST	57.2	3.1	5.3	117	D	Y
C8	4-23	BL,ST	65.3	17.5	4.6	118	B	Y
C9	4-23	BL,ST	75.7	-13.9	4.9	140	D	Y
C10	4-25	BL,ST	10.2	23.5	8.1	212	C	Y

NOTE: BL = charge shape—block, S = charge shape—spherical, ST = surface tangent, STB = surface tangent buried, AGL = above ground level, Y = yes, N = no, ND = no data.

* A – 7.5 lb of C-4, B = 15 lb of C-4, C – 25 lb of C-4.

** Three 15-lb shots in series.

Table 2
High-Explosive Trial Log, DOT II

Trial*	Date (1983)	Charge Config-uration	Detonation Coordinates Distance m	Detonation Coordinates Azimuth deg	Wind m/sec	Wind deg	Pasquill Category	Crater Profile
01B(8)**	8-4	S,ST	50	150	2.5	170	ND	Y
02B(9)	8-4	S,ST	46	179	2.7	155	ND	Y
03C(10)	8-4	S,ST	45	165	2.5	110	ND	Y
04B(11)	8-4		50	112	3.4	115	ND	Y
			50	97				
05B(14)	8-5	S,ST	46	75	3.4	80	ND	Y
			47	61				Y
			46	45				Y
06C(15)	8-5	S,ST	55	75	2.9	75	ND	Y
			51	91				Y
			ND	ND				ND
07C(16)	8-5	S,ST	37	90	4.0	75	ND	ND
08(17)†	8-5	S,ST	ND	ND	ND	ND	ND	ND

NOTE: S = charge shape—spherical, ST = surface tangent, Y = yes, ND = no data.

* B = 15 lb of C-4, C = 25 lb of C-4.

** Trial number of DOT II records in parentheses. The leading alphanumeric identifier will be used to designate the high-explosive DOT II shots in this report.

† Three 20-lb charges/no data available.

Table 3
Crater Volumes

Trial	Preshot Density g/cm³	Moisture Content %	Bulking Factor dimensionless	Apparent Volume m³	True Volume m³	Apparent Volume/ kg TNT m³/kg TNT
A1	-	11.5	-	0.118	0.420	0.032
A2	1.43	13.1	1.53	0.151	0.493	0.040
A3	-	10.4	-	0.065	0.242	0.017
A4	1.54	33.3	1.42	0.110	0.204	0.029
A5	1.32	26.7	1.24	0.095	0.178	0.025
A6	1.38	13.9	1.32	0.126	0.383	0.034
A7	1.38	13.0	-	0.140	0.378	0.037
A8	1.36	11.4	-	0.107	0.161	0.029
A9	1.39	9.3	1.20	0.172	0.429	0.046
B1	1.36	19.5	1.55	0.263	0.750	0.035
B2	1.52	22.0	1.60	0.224	0.848	0.030
B3	1.36	13.3	1.46	0.215	0.738	0.029
B5	-	11.5	-	1.252	2.375	0.318
B6	1.38	13.1	1.33	0.231	1.260	0.031
B7*	1.28	11.8	1.12	0.230	0.840	0.031
B8	1.43	12.4	1.27	0.335	0.930	0.045
B9	1.42	12.9	1.25	0.221	0.529	0.030
B10	1.37	12.4	1.18	0.191	0.875	0.026
B11	1.34	11.8	1.33	0.143	0.547	0.019
B12	1.28	12.1	1.06	0.779	1.674	0.104
B13	1.44	7.2	1.21	0.440	2.013	0.059
B15	1.26	-	1.13	0.810	1.832	0.108
C1	1.44	23.6	1.46	0.465	0.893	0.037
C2	1.84	11.2	1.92	0.440	1.350	0.035
C3	1.26	12.8	1.20	0.510	1.139	0.041
C4*	1.36	13.5	1.20	0.310	0.800	0.025
C5*	1.23	12.7	1.10	0.560	1.300	0.045
C6	1.34	13.9	1.18	0.484	1.284	0.039
C7	1.31	11.6	1.19	0.392	1.862	0.031
C8	1.48	12.1	1.32	0.481	1.598	0.039
C9	1.45	11.7	1.33	0.694	1.327	0.056
C10	1.31	12.4	1.55	0.443	1.335	0.036
1B	1.71	11.6	-	0.320	0.480	0.043
2B	1.94	17.5	-	0.188	0.254	0.025
3C	1.93	13.2	-	0.393	0.517	0.032
4B(a)	1.78	11.6	-	0.243	0.309	0.033
4B(b)	1.70	10.5	-	0.151	0.288	0.020
5B(a)	1.69	7.9	-	0.196	0.238	0.026
5B(b)	1.50	8.2	-	0.110	0.228	0.015
5B(c)	1.71	5.0	-	0.118	0.256	0.016
6C(a)	1.79	8.1	-	0.360	0.481	0.029
6C(b)	1.62	8.3	-	0.323	0.467	0.026

* Only crater diameters and central depths were recorded. Volumes are calculated assuming these craters to be cone shaped.

Table 4
Mean Crater Volumes,* m³

Charge Weight lb	Apparent DOT I	Apparent DOT II	True DOT I	True DOT II
7.5 (ST)	0.119	-	0.320	-
	(0.120)	-	(0.321)	-
15.0 (ST)	0.226	0.187	0.745	0.281
	(0.228)	(0.189)	(0.809)	(0.293)
25.0 (ST)	0.490	0.357	1.345	0.486
	(0.489)	(0.359)	(1.349)	(0.488)
15.0 (STB)	0.674	-	1.835	-
	(0.674)	-	(1.837)	-

* These volumes are calculated from mean crater profiles (see text). Values in parentheses are means computed from the volumes of the individual craters listed in Table 3. Crater volumes B7, C4, and C5 have been omitted from these mean calculations as no profiles were measured. The B5 volume has also been omitted as the charge was inadvertently placed on a core sample hole.

Table 5
Mass Excavation for ST Shots

Test	Charge Weight lb	Density, g/cm³ Wet	Density, g/cm³ Dry	Moisture Content %	Apparent Volume m³	Calculated Excavated Mass kg	Volume/ kg TNT
DOT I	7.5	1.40	1.19	17.2	0.119	142	0.032
DOT I	15	1.40	1.22	14.7	0.226	276	0.030
DOT II	15	1.72	1.56	10.3	0.187	292	0.025
DOT I	25	1.40	1.23	13.7	0.490	603	0.039
DOT II	25	1.78	1.62	9.9	0.357	578	0.029

Table 6
Path Integrated Dosage and Mass Extinction
[Mass Extinction Coefficients, m^2/g]

Trial	Dosage Integration $g \cdot sec/m^2$	Wavelength λ, μm			
		0.4–0.7	1.06	3.8	8.4–12
B4	264.	0.21	0.18	0.15	0.16
B5	1,910.	0.14	0.15	0.11	0.08
B6	104.	0.21	0.14	0.12	0.12
C4	149.	0.28	0.26	0.19	0.24
A7	156.	0.17	0.18	0.12	0.12
A8	192-250	0.12-0.16	0.13-0.17	0.10-0.14	0.11-0.15
B10	186.	0.16	0.14	0.11	0.11
B13	388.	0.16	0.18	0.12	0.11
Average		0.18	0.16	0.12	0.13

Table 7
Mean Dust Cloud Heights for DOT 1, m

Charge Weight	Video Tapes Visible			Vertical Samplers		
	Number of Clouds	Mean Height, m	Standard Deviation, m	Number of Clouds	Mean Height, m	Standard Deviation, m
A	3	30.3	12.7	-	-	-
B	6	29.7	14.5	5	14.5	2.3
C	7	27.9	3.7	8	18.4	4.3

Table 8
Cloud Masses, g

Shot	ASL Calculations: Hoock	Modified Hoock	Bruce	Rectangular Bruce	PEDCo, Inc.
A3	9,660	-	-	-	-
A5	8,460	-	-	-	-
A6	1,792	-	-	-	-
B1	21,170	-	-	-	-
B3	6,860	-	-	-	-
B4	25,825	11,156	1,841	2,798	-
B5	51,375	-	-	-	-
B6	7,218	6,015	5,756	8,908	-
B7	14,680	14,391	370	650	-
B8	17,400	-	-	-	-
B9	18,612	-	-	-	-
B11	-	-	4,060	6,675	-
B15	-	-	7,209	5,807	-
C1	25,740	17,846	7,976	2,439	-
C3	-	-	4,494	2,665	-
C4	14,390	11,427	5,934	12,812	-
C5	45,210	23,392	8,941	16,264	-
C6	22,734	15,830	4,076	5,953	-
C7	17,870	-	-	-	-
C8	19,068	10,555	11,426	4,990	-
C9	40,545	22,426	4,520	4,881	-
C10	-	-	1,645	8,393	-
01B	-	-	-	-	6,396
02B	-	-	-	-	4,354
03C	-	-	-	-	7,167
07C	-	-	-	-	5,625

Table 9
Cloud Mass Means, g

Method	Shots A*	Shots B	Shots C
Modified Hoock	6,600 (4,200)	10,500 (4,200)	16,800 (5,400)
Bruce	-	3,900 (2,000)	6,100 (3,100)
Rectangular Bruce	-	6,100 (3,100)	7,300 (4,900)
PEDCo	-	5,400 (1,400)	6,400 (1,100)
Average of means	-	6,500	9,200
Mean for individual shots**	-	6,600 (3,400)	9,200 (6,122)

NOTE: Masses for B7 and B15 shots have been omitted from all calculations in Table 10. Standard deviations are in parentheses, and all table values have been rounded to the nearest hundred grams.

* Unmodified Hoock values. No A shots passed through the vertical sampler.

** The following shots were used to calculate the means for individual shots:

B: Modified Hoock—B4, B6, B7
Bruce, Rectangular Bruce—B4, B6, B11
PEDCo—01B, 02B

C: Modified Hoock—C1, C4, C5, C6, C8, C9
Bruce, Rectangular Bruce—C1, C3, C4, C5, C6, C8, C9, C10
PEDCo—03C, 07C

Table 10
Sustained Cloud Dust

Shot	Excavated Mass Means, kg	Cloud Mass Means, kg	Percent Excavated in Clouds
A*	142	6.6**	4.6
B	284	6.6	2.3
C	591	9.2	1.6

* Calculated from DOT 1 data only.

** Unmodified Hoock method.

Table 11
Density Radii

Shot	2.5-m Density g/cm³	Radii, m: Wavelength: Visible	1.06 μm	3.4 μm	8.4–12 μm	Mean	Bruce Mean
B4	1.864	11.62 (0.001)*	10.99 (0.003)	13.04 (0.0057)	13.30 (0.0038)	12.24	6.54
B6	1.782	12.85 (0.001)	5.50 (0.0623)	5.08 (0.1459)	6.39 (0.0727)	7.28	10.20
B11	2.601	6.72 (0.0038)	7.59 (0.0037)	6.85 (0.0227)	11.53 (0.001)	8.17	7.14
B15	6.002	3.00 (0.0032)	3.48 (0.0027)	3.15 (0.0180)	4.87 (0.0012)	3.63	4.74
		Means for 15-lb shots				7.83	7.16
C1	1.795	12.06 (0.001)	12.10 (0.0021)	13.89 (0.005)	13.61 (0.0036)	12.91	6.30
C3	1.042	18.69 (0.002)	23.37 (0.001)	31.17 (0.001)	28.77 (0.001)	25.50	8.34
C4	1.267	17.09 (0.001)	16.56 (0.0026)	16.63 (0.0113)	23.66 (0.001)	19.17	13.26
C5	1.093	19.81 (0.001)	22.28 (0.001)	29.71 (0.001)	27.43 (0.001)	24.81	16.14
C8	4.186	5.17 (0.001)	4.42 (0.0053)	4.65 (0.0161)	6.89 (0.0013)	5.28	7.44
C9	1.412	15.33 (0.001)	12.85 (0.0058)	13.59 (0.0169)	11.31 (0.0252)	13.27	7.92
C10	1.740	12.44 (0.001)	11.04 (0.0043)	10.55 (0.201)	17.23 (0.001)	12.81	6.66
		Means for 25-lb shots				16.25	9.44

* Minimum transmission is given in parentheses.

Table 12
Obscuration Widths (Visible)

Shot	WSP m/sec	WSP (⊥)	PASQ	Cloud Age, sec	Percent Transmission Widths, m 50	37 (e^{-1})	10	2
A3	8.16	4.56	D	14.5	50.2	18.2	0.0	0.0
A5	2.33	2.13	C	14.5	12.8	0.0	0.0	0.0
A6	6.29	3.42	D	7.9	13.7	10.3	0.0	0.0
A7	5.71	4.16	C	8.5	33.3	33.3	16.7	4.6
A9	2.61	2.61	A	7.3	28.7	23.5	13.1	7.8
B1	3.03	2.93	A	11.8	64.4	44.0	20.5	2.9
B2	2.98	2.73	B	13.0	57.3	43.7	2.7	0.0
B3	6.66	2.71	C	14.1	27.1	24.4	16.3	5.4
B4	6.76	4.32	C	11.3	51.8	43.2	30.2	25.9
B6	6.20	3.13	D	10.5	25.0	18.8	6.3	3.1
B7	8.79	4.83	D	6.1	53.1	48.3	33.8	29.0
B8	3.99	3.12	B	6.9	56.1	34.3	12.5	9.4
B9	3.61	1.92	C	21.1	23.1	21.2	7.7	3.9
C1	2.81	2.02	D	12.7	68.6	58.5	30.3	14.1
C4	7.02	4.33	D	9.1	43.3	43.3	26.0	8.7
C5	8.82	1.62	C	19.2	48.7	47.0	34.1	21.1
C7	5.32	4.32	D	8.5	60.5	34.6	17.3	4.3
C8	4.60	3.76	B	6.0	41.4	37.6	22.6	11.3
C9	4.85	4.73	D	11.4	71.0	61.5	37.9	18.9
(A)*	5.02	3.38	-	10.5	27.7	17.1	6.0	2.5
					(15.5)**	(12.7)	(8.3)	(3.6)
(B)	5.25	3.21	-	11.9	44.7	34.7	16.3	10.0
					(16.7)	(11.7)	(11.3)	(11.2)
(C)	5.57	3.46	-	11.2	55.6	47.2	28.0	13.1
					(12.9)	(11.0)	(7.6)	(6.3)

NOTE: WSP = wind speed, WSP (⊥) = wind speed perpendicular to the transmissometer line-of-sight, PASQ = Pasquill Stability Category.

* Mean values for charge weight.

** Standard deviations are displayed in parentheses.

Table 13
Obscuration Widths (1.06 μm)

Shot	WSP m/sec	WSP ($\perp$)	PASQ	Cloud Age, sec	Percent Transmission Widths, m: 50	37 (e^{-1})	10	2
A3	8.16	4.56	D	14.5	54.7	18.2	0.0	0.0
A5	2.33	2.13	C	14.5	10.7	0.0	0.0	0.0
A6	6.29	3.42	D	7.9	20.5	13.7	0.0	0.0
A7	5.71	4.16	C	8.5	33.3	33.3	16.6	8.3
A9	2.61	2.61	A	7.3	28.7	20.9	13.1	10.4
B1	3.03	2.93	A	11.8	61.5	44.0	20.5	0.0
B2	2.98	2.73	B	13.0	57.3	43.7	5.5	0.0
B3	6.66	2.71	C	14.1	27.1	24.4	16.3	10.8
B4	6.76	4.32	C	11.3	51.8	43.2	34.6	21.6
B6	6.20	3.13	D	10.5	25.0	21.9	3.1	0.0
B7	8.79	4.83	D	6.1	53.1	48.3	33.8	29.0
B8	3.99	3.12	B	6.9	56.1	31.2	12.5	6.2
B9	3.61	1.92	C	21.1	25.0	19.2	5.8	1.9
C1	2.81	2.02	D	12.7	72.7	60.6	34.3	24.2
C4	7.02	4.33	D	9.1	47.6	43.3	30.3	17.3
C5	8.82	1.62	C	19.2	50.2	47.0	35.6	22.7
C7	5.32	4.32	D	8.5	60.5	34.6	25.9	8.6
C8	4.60	3.76	B	6.0	41.4	37.6	26.3	15.0
C9	4.85	4.73	D	11.4	71.0	61.5	42.6	9.5
(A)*	5.02	3.38	-	10.5	29.6	13.6	5.9	3.7
					(16.5)**	(13.3)	(8.2)	(5.2)
(B)	5.25	3.21	-	11.9	44.6	34.5	16.5	8.7
					(15.9)	(11.6)	(12.4)	(11.1)
(C)	5.57	3.46	-	11.2	57.2	47.4	32.5	16.2
					(12.9)	(11.4)	(6.4)	(6.5)

NOTE: WSP = wind speed, WSP ($\perp$) = wind speed perpendicular to the transmissometer line-of-sight, PASQ = Pasquill Stability Category.

* Mean values for charge weight.

** Standard deviations are displayed in parentheses.

Table 14
Obscuration Widths (3.8 μm)

Shot	WSP m/sec	WSP (⊥)	PASQ	Cloud Age, sec	Percent Transmission Widths, m 50	37 (e^{-1})	10	2
A3	8.16	4.56	D	14.5	36.5	4.6	0.0	0.0
A5	2.33	2.13	C	14.5	6.4	0.0	0.0	0.0
A6	6.29	3.42	D	7.9	13.7	10.3	0.0	0.0
A7	5.71	4.16	C	8.5	33.3	29.1	12.5	0.0
A9	2.61	2.61	A	7.3	26.1	20.9	10.4	2.6
B1	3.03	2.93	A	11.8	55.7	44.0	20.5	0.0
B2	2.98	2.73	B	13.0	49.1	38.2	0.0	0.0
B3	6.66	2.71	C	14.1	27.1	24.4	13.6	5.4
B4	6.76	4.32	C	11.3	51.8	43.2	30.2	17.3
B6	6.20	3.13	D	10.5	21.9	18.8	0.0	0.0
B7	8.79	4.83	D	6.1	53.1	48.3	29.0	0.0
B8	3.99	3.12	B	6.9	49.9	25.0	9.4	3.1
B9	3.61	1.92	C	21.1	25.0	19.2	5.8	0.0
C1	2.81	2.02	D	12.7	64.6	58.5	30.3	20.2
C4	7.02	4.33	D	9.1	47.6	39.0	21.7	8.7
C5	8.82	1.62	C	19.2	48.7	47.0	29.2	14.6
C7	5.32	4.32	D	8.5	51.8	34.6	25.9	0.0
C8	4.60	3.76	B	6.0	41.4	37.6	18.8	3.8
C9	4.85	4.73	D	11.4	71.0	61.5	33.1	4.7
(A)*	5.02	3.38	-	10.5	23.2	13.0	4.6	0.5
					(12.8)**	(11.9)	(6.3)	(1.2)
(B)	5.25	3.21	-	11.9	41.7	32.6	13.6	3.2
					(14.3)	(12.0)	(12.0)	(6.0)
(C)	5.57	3.46	-	11.2	54.2	46.4	26.5	8.7
					(11.3)	(11.4)	(5.4)	(7.5)

NOTE: WSP = wind speed, WSP (⊥) - wind speed perpendicular to the transmissometer line-of-sight, PASQ = Pasquill Stability Category.

* Mean values for charge weight.

** Standard deviations are displayed in parentheses.

Table 15
Obscuration Widths (8.4–12 μm)

Shot	WSP m/sec	WSP (⊥)	PASQ	Cloud Age, sec	Percent Transmission Widths, m 50	37 (e^{-1})	10	2
A3	8.16	4.56	D	14.5	18.2	0.0	0.0	0.0
A5	2.33	2.13	C	14.5	2.1	0.0	0.0	0.0
A6	6.29	3.42	D	7.9	13.7	3.4	0.0	0.0
A7	5.71	4.16	C	8.5	33.3	29.1	12.5	0.0
A9	2.61	2.61	A	7.3	23.5	20.9	13.1	2.6
B1	3.03	2.93	A	11.8	46.9	35.2	14.7	0.0
B2	2.98	2.73	B	13.0	43.7	21.8	0.0	0.0
B3	6.66	2.71	C	14.1	24.4	21.7	13.6	8.1
B4	6.76	4.32	C	11.3	43.2	43.2	30.2	21.6
B6	6.20	3.13	D	10.5	21.9	15.7	6.3	0.0
B7	8.79	4.83	D	6.1	48.3	43.5	29.0	14.5
B8	3.99	3.12	B	6.9	31.2	18.7	12.5	9.4
B9	3.61	1.92	C	21.1	21.1	19.2	5.8	0.0
C1	2.81	2.02	D	12.7	58.6	46.5	26.3	12.1
C4	7.02	4.33	D	9.1	39.0	39.0	26.0	17.3
C5	8.82	1.62	C	19.2	47.0	43.7	24.3	11.3
C7	5.32	4.32	D	8.5	34.6	34.6	17.3	13.0
C8	4.60	3.76	B	6.0	37.6	37.6	22.6	7.5
C9	4.85	4.73	D	11.4	66.2	56.8	23.7	0.0
(A)*	5.02	3.38	-	10.5	18.5	10.7	5.1	0.5
					(11.6)**	(13.5)	(7.0)	(1.2)
(B)	5.25	3.21	-	11.9	35.1	27.4	14.0	6.7
					(11.7)	(11.4)	(10.8)	(8.2)
(C)	5.57	3.46	-	11.2	47.2	43.0	23.4	10.2
					(12.7)	(8.0)	(3.3)	(5.9)

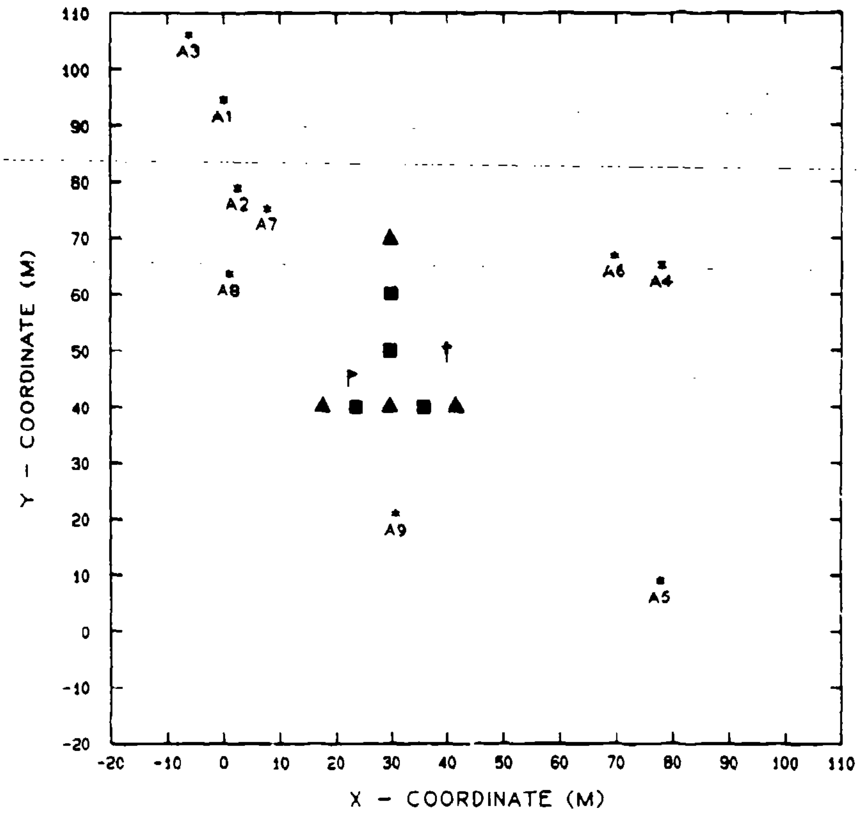
NOTE: WSP = wind speed, WSP (⊥) = wind speed perpendicular to the transmissometer line-of-sight, PASQ = Pasquill Stability Category.

* Mean values for charge weight.

** Standard deviations are displayed in parentheses.

APPENDIX A: DATA COLLECTED IN DOT I AND DOT II EXERCISES

APRIL (DOT I) 7.5 LB SHOTS



■ — HI-VOL SAMPLERS

▲ — NEPHELOMETER AND HI-VOL SAMPLERS

* — POINT OF BURST FOR 7.5-LB SHOTS

┌ — 2-M MET TOWER

† — 16-M MET TOWER

EVENT SUMMARY DATA

Test Number: HEA1

Date: 19 APRIL 83

Detonation Coordinates (M):
X: 0.0
Y: 94.5

Surface Tangent

Charge Shape: BLOCK

Charge Wt: 7.5 LB
Event Time: 11:18:59

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.361

16 Meter Tower (Means)
Start Time: 11:18:24 End Time: 11:20:29

	2M	4M	6M	16M
Wind Speed (M/S)	5.42	5.98	6.13	6.94
Wind Dir. (DEG)	230.3	230.4	231.2	229.4
Sigma WSP	1.09	1.03	0.99	1.04
Sigma WDIR	15.9	15.2	15.8	15.5
UVW Components				
U (N-S) (M/S)	3.31	3.64	3.64	4.27
V (E-W) (M/S)	4.03	4.49	4.66	5.17
W (Vert) (M/S)	0.15	0.51	0.21	*
Sigma U	1.27	1.20	1.16	1.19
Sigma V	1.33	1.43	1.57	1.73
Sigma W	0.21	0.32	0.41	*
Temperature (C)	20.4	19.4	19.0	18.4

Soil Temperature (C): 30.7

Dew Point (C): -5.8

Temperature (C): 18.8

Rel. Hum. (%): 17.3

Abs. Hum. (G/M**3): 2.79

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 1017.0

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: *
Target: *

Sky-Target Contrast: *

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	3.0 90.0	62	192	545	750+
Post-Shot	3.0 90.0	38	96	367	750+

CRATER DATA

Moisture Content: 11.5

CRATER VOLUMES (M**3):
True Crater: 0.420
Apparent Crater: 0.118
Flow: 0.303

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: 1.002
Bottom: *
Side: *

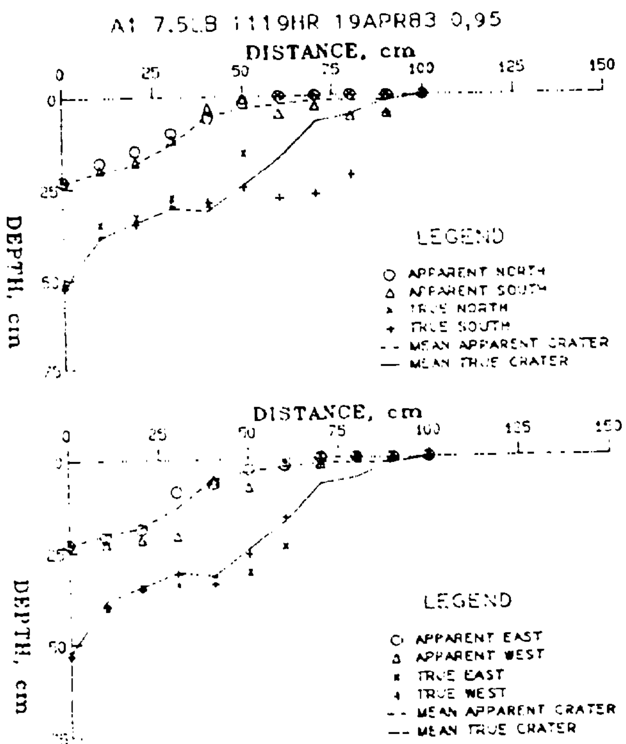
HI VOL DATA (G):

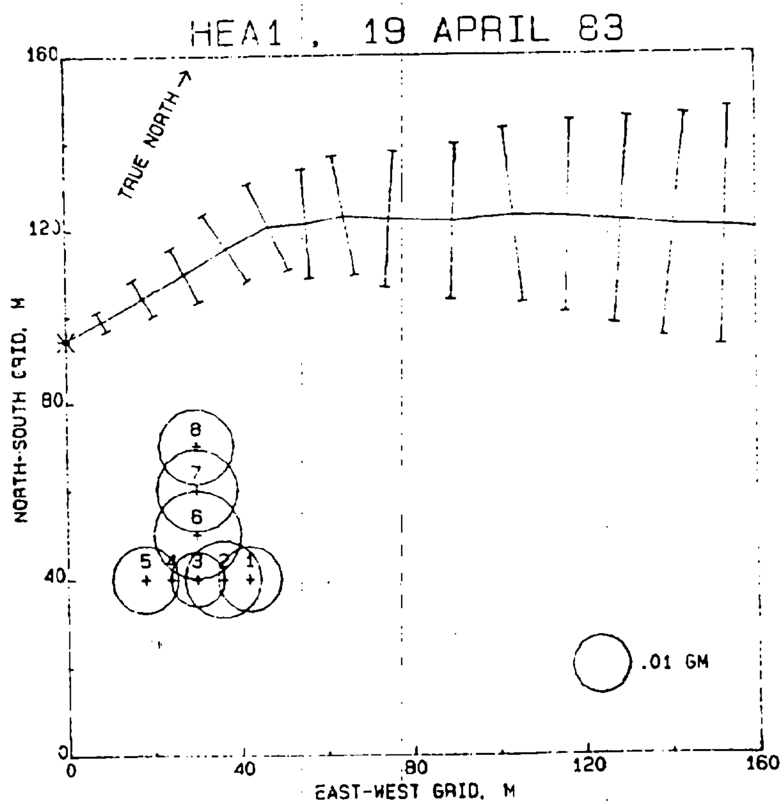
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0129	0.0177	0.0088	0.0000	0.0139	0.0233	0.0203	0.0171

SUM: 0.1140

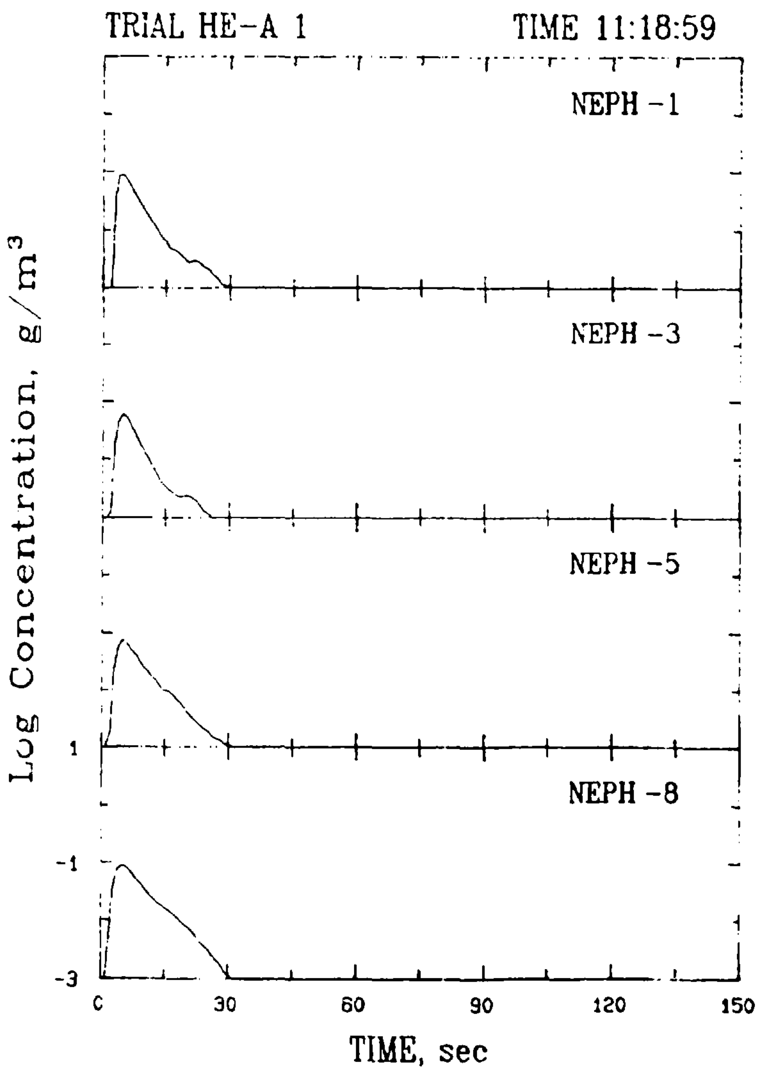
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

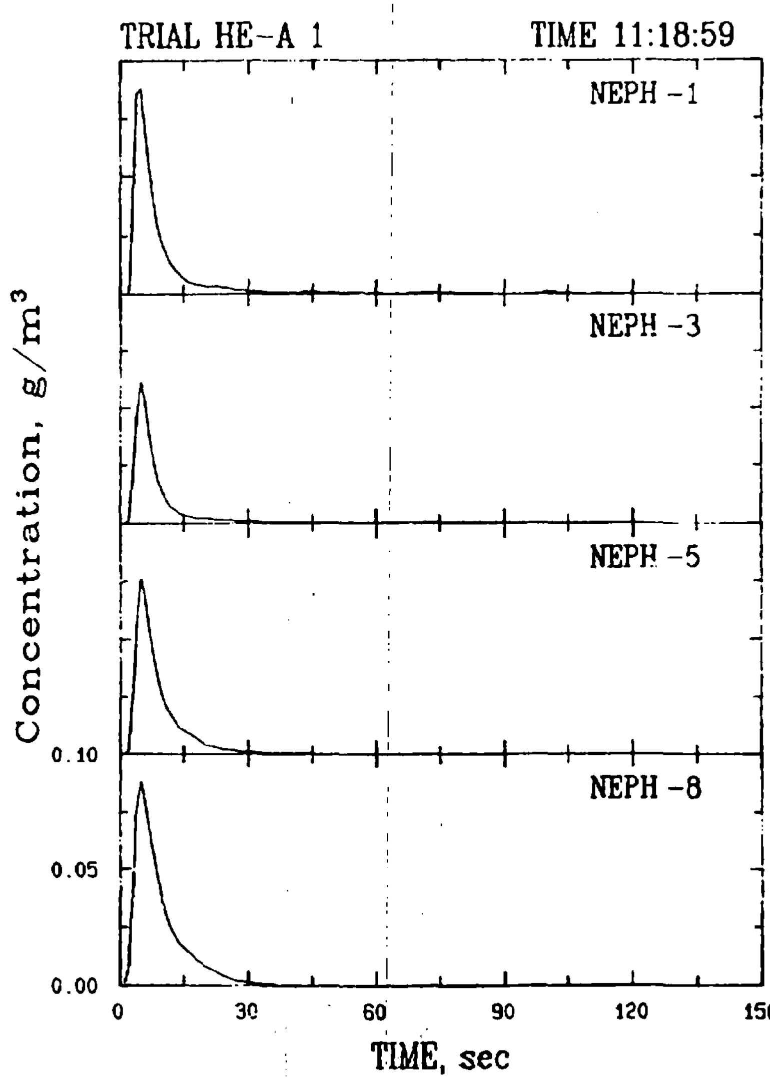




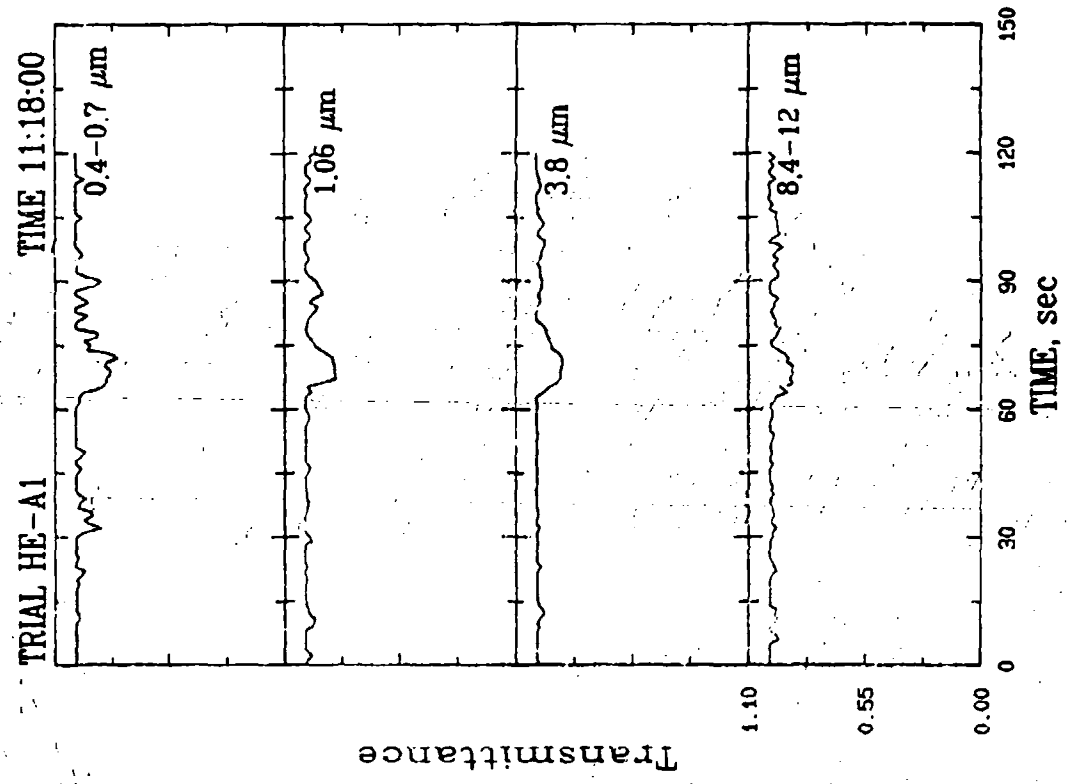
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS



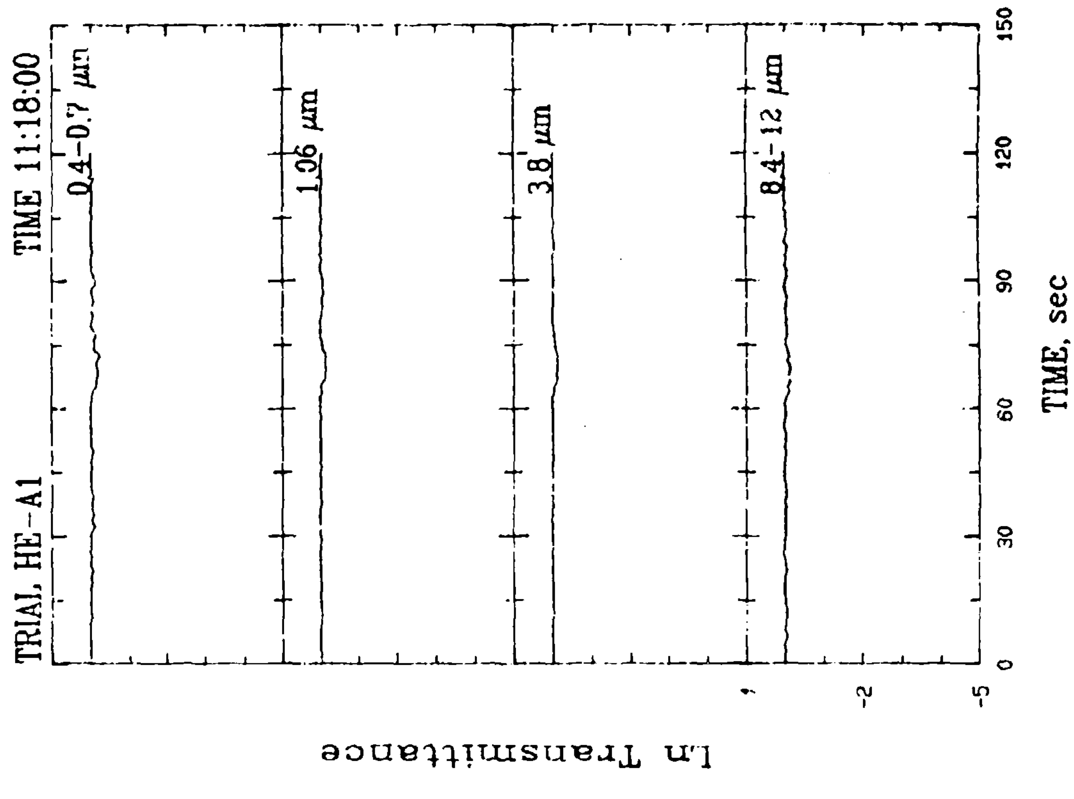
TRIAL HE-A 1
TIME 11:18:59
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



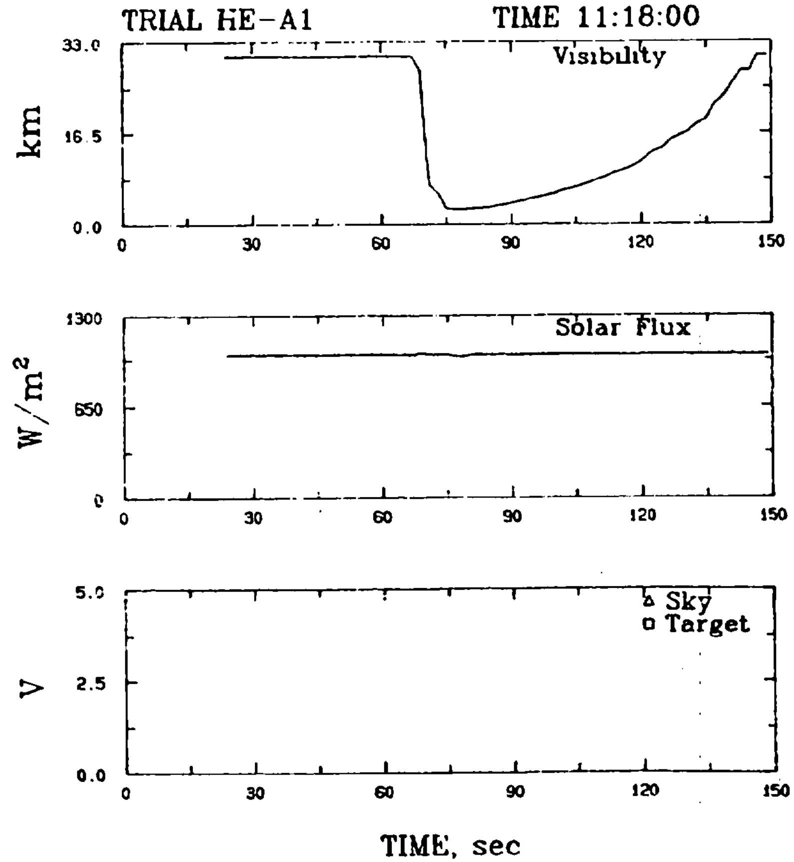
TRIAL HE-A 1
TIME 11:18:59
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.10
0.05
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A1
TIME 11:18:00
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A1
TIME 11:18:00
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A1
TIME 11:18:00
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m2
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEA2

Surface Tangent

Date: 19 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 2.4
Y: 78.9

Charge Wt: 7.5 LB
Event Time: 13:57:01

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.222

16 Meter Tower (Means)
Start Time: 13:56:16 End Time: 13:59:15

	2M	4M	6M	16M
Wind Speed (M/S)	5.89	6.46	6.76	7.67
Wind Dir. (DEG)	259.3	258.2	258.7	253.7
Sigma WSP	2.32	2.51	2.51	2.74
Sigma WDIR	15.1	13.7	12.6	10.3
UVW Components				
U (N-S) (M/S)	1.41	1.64	1.62	2.39
V (E-W) (M/S)	5.50	6.03	6.38	7.15
W (Vert) (M/S)	0.04	0.36	0.22	*
Sigma U	2.07	2.21	2.12	2.09
Sigma V	1.90	2.02	2.06	2.26
Sigma W	0.20	0.45	0.46	*
Temperature (C)	22.6	21.7	21.5	20.6

Soil Temperature (C): 35.3

Solar Flux (W/M**2): 871.9

Dew Point (C): -6.9

Visual Range (M): 30480.0

Temperature (C): 20.8

Vista Ranger Voltages:
Sky: 3.28
Target: 0.78

Rel. Hum. (%): 13.8

Abs. Hum. (G/M**3): 2.51

Sky-Target Contrast: -0.76

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	3.0 77.0	50	190	515	750+
Post-Shot	3.0 77.0	50	100	433	750+

CRATER DATA

Moisture Content: 13.1

CRATER VOLUMES (M**3):
True Crater: 0.493
Apparent Crater: 0.151
Flow: 0.342

DENSITIES (G/CM**3):
Pre-Shot: 1.430
Flow: 0.933
Bottom: *
Side: *

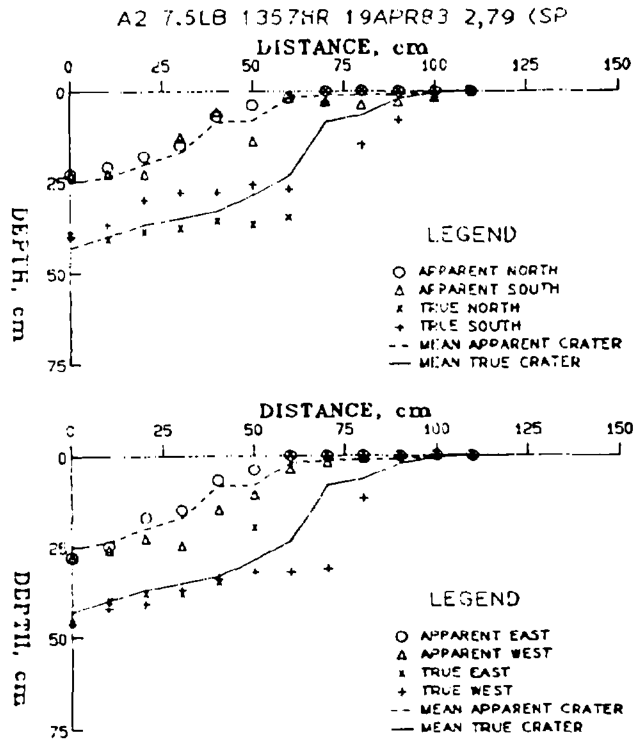
HI VOL DATA (G):

HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0375	0.0370	0.0294	0.0464	0.0461	0.0590	0.0767	0.1768

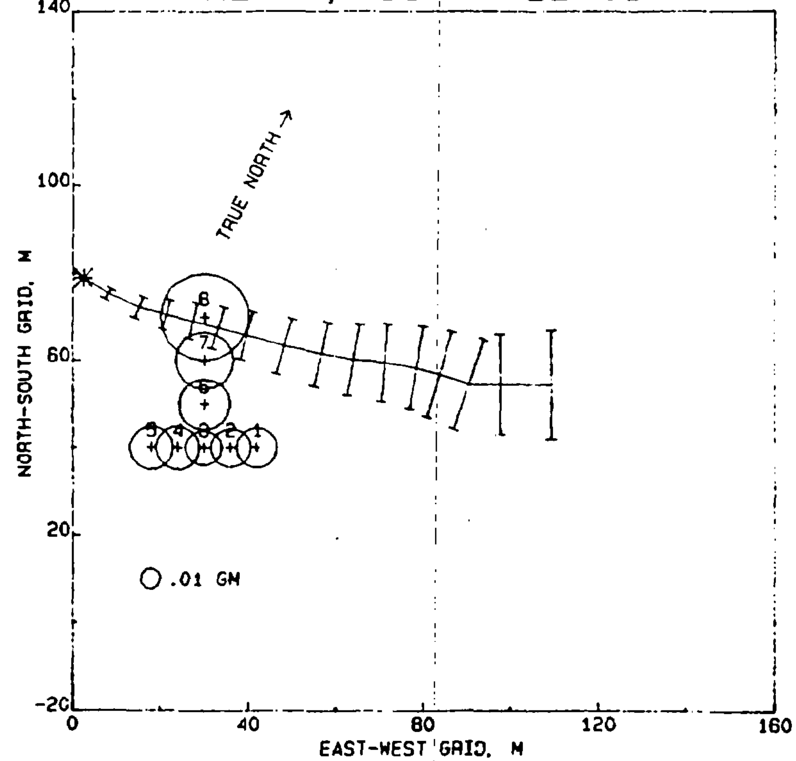
SUM: 0.5089

GELMAN DOSAGE (G S/M**3):

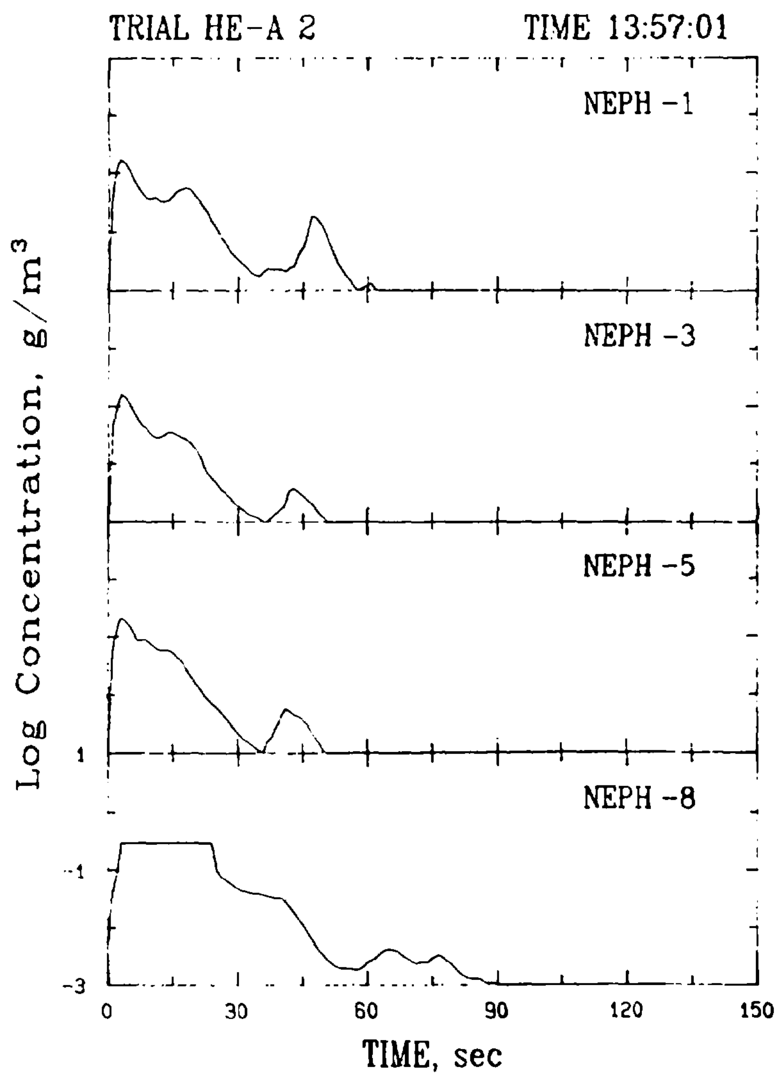
GELMAN A	GELMAN B	GELMAN C	GELMAN D
60.948	0.000	5.978	0.000

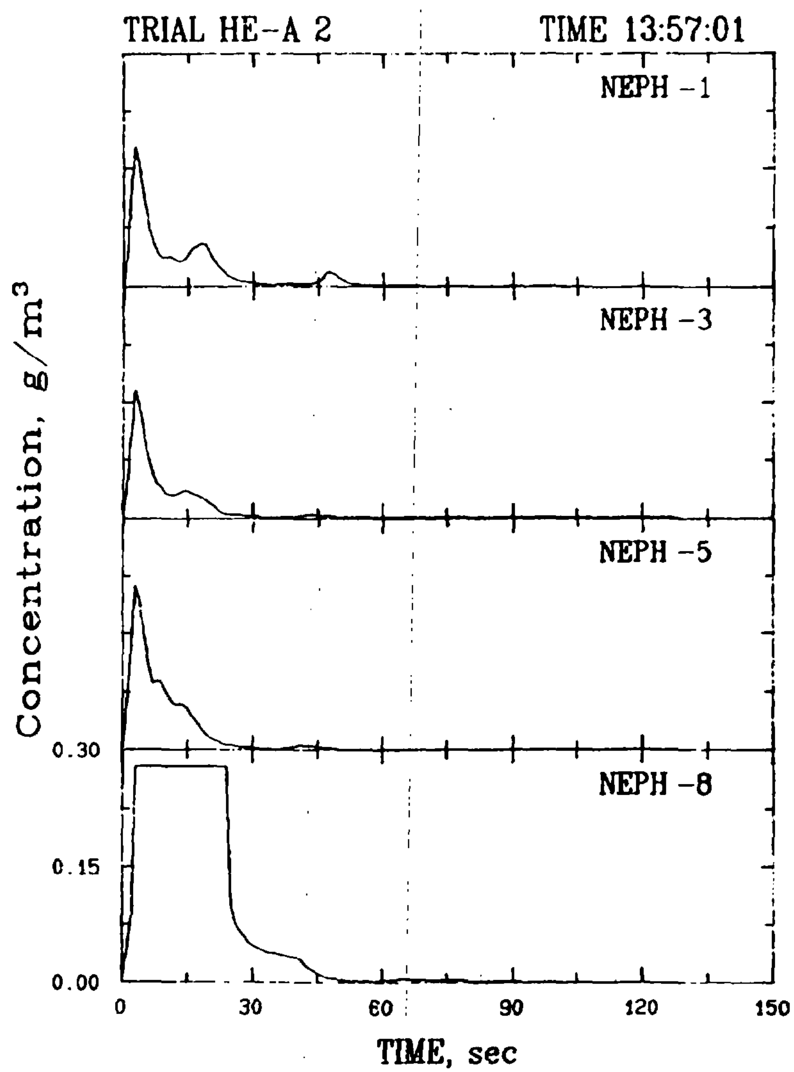


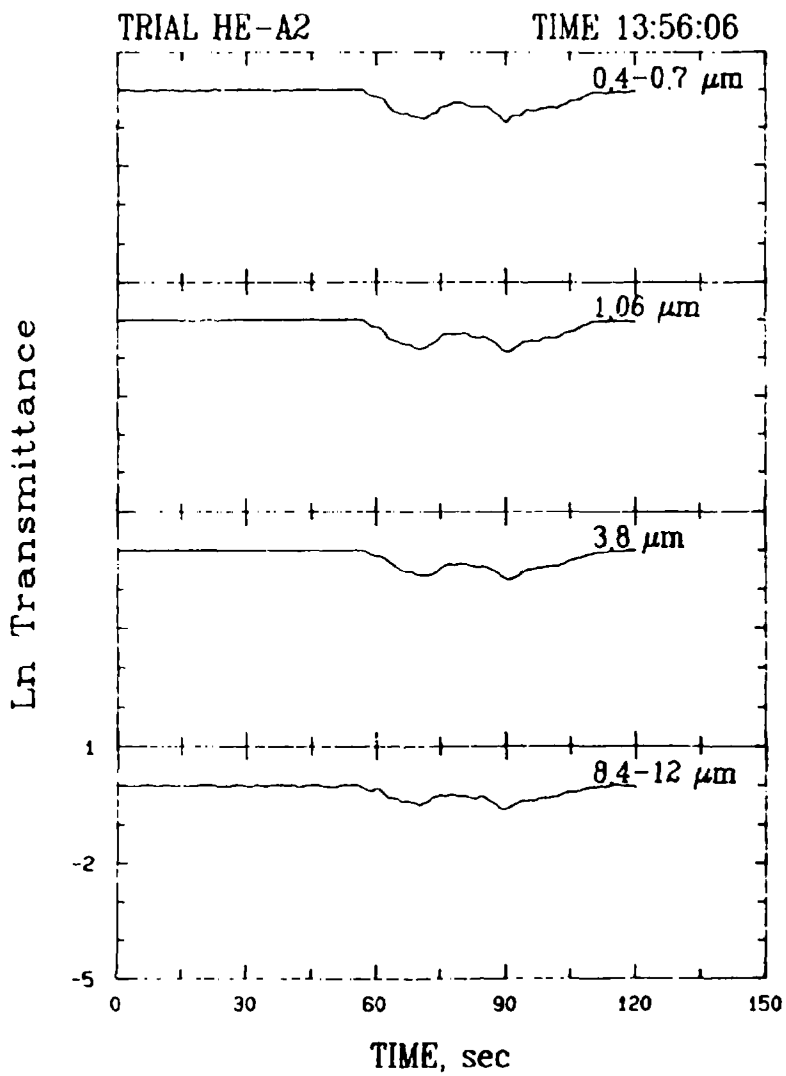
HEA2 , 19 APRIL 83

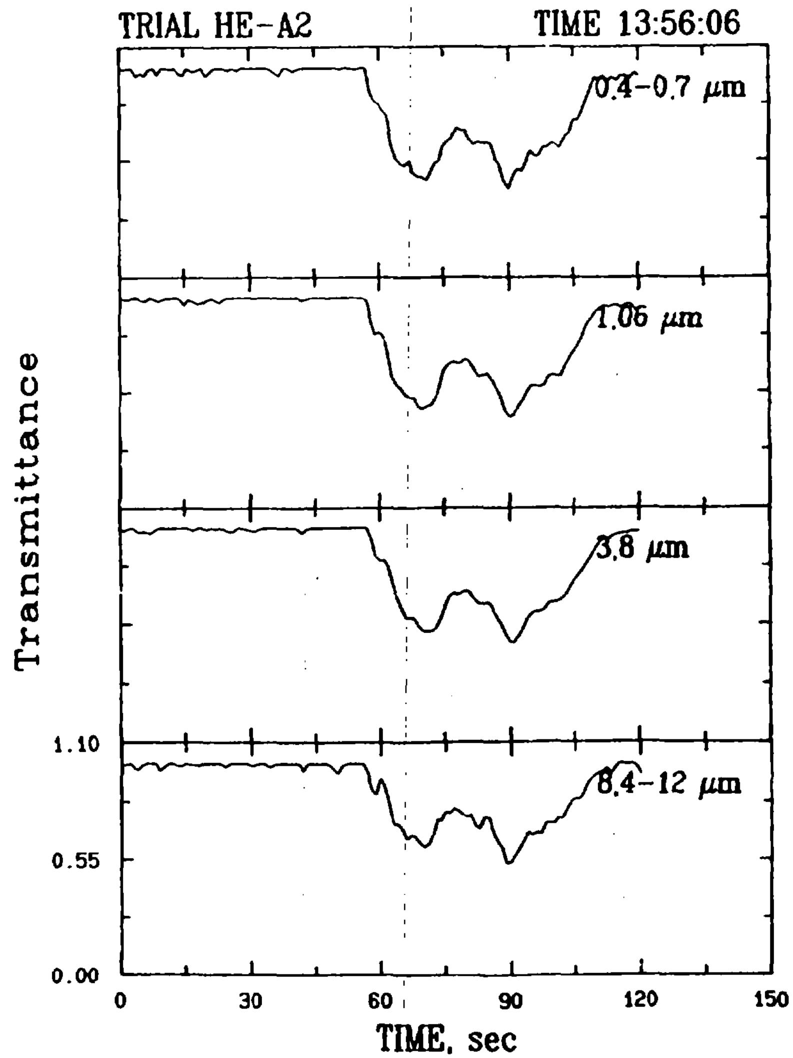


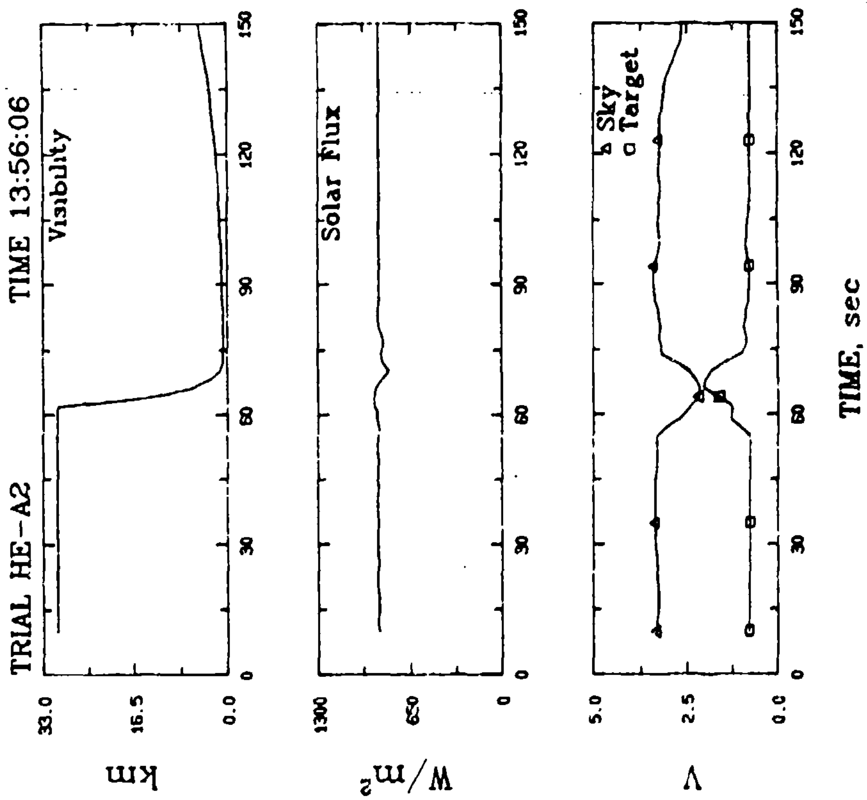
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-A 2
TIME 13:57:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-A 2
TIME 13:57:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.30
0.15
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A2
TIME 13:56:06
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A2
TIME 13:56:06
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A2
TIME 13:56:06
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEA3

Surface Tangent

Date: 19 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: -6.1
Y: 106.1

Charge Wt: 7.5 LB
Event Time: 15:17:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.291

16 Meter Tower (Means)
Start Time: 15:15:50 End Time: 15:18: 6

	2M	4M	6M	16M
Wind Speed (M/S)	8.16	8.64	9.06	9.60
Wind Dir. (DEG)	278.0	275.5	273.8	271.7
Sigma WSP	1.53	1.47	1.47	1.57
Sigma WDIR	5.9	5.6	5.0	5.8
UVW Components				
U (N-S) (M/S)	-1.14	-0.84	-0.60	-0.25
V (E-W) (M/S)	8.04	8.56	9.00	9.55
W (Vert) (M/S)	0.18	0.50	0.53	*
Sigma U	0.86	0.83	0.77	0.95
Sigma V	1.51	1.47	1.47	1.57
Sigma W	0.32	0.44	0.47	*
Temperature (C)	22.9	22.5	22.3	21.0

Soil Temperature (C): 30.6

Solar Flux (W/M**2): 696.5

Dew Point (C): -7.7

Visual Range (M): 30480.0

Temperature (C): 21.8

Vista Ranger Voltages:
Sky: 2.48
Target: 0.77

Rel. Hum. (%): 12.2

Abs. Hum. (G/M**3): 2.35

Sky-Target Contrast: -0.69

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	-3.0 105.0	100	150	483	750+
Post-Shot	-3.0 105.0	*	*	*	*

CRATER DATA

Moisture Content: 10.4

CRATER VOLUMES (M**3):
True Crater: 0.242
Apparent Crater: 0.065
Flow: 0.176

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: 1.131
Bottom: *
Side: *

HI VOL DATA (G):

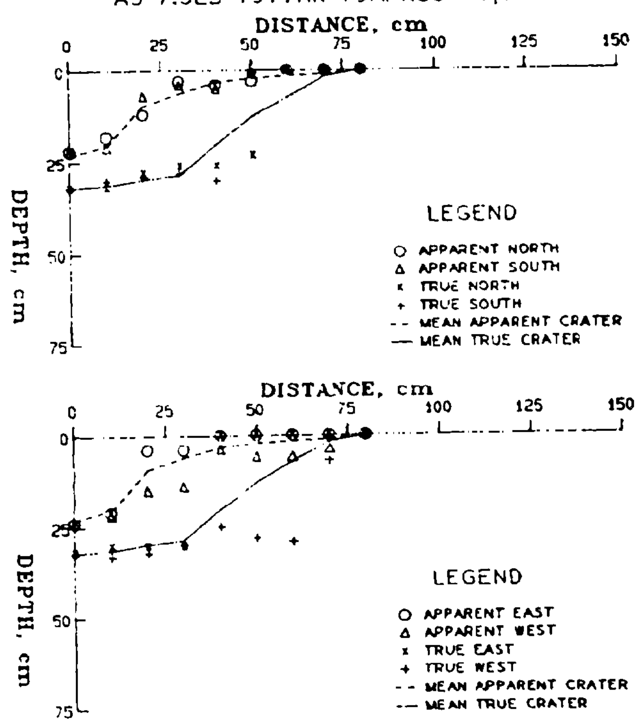
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0332	0.0158	0.0188	0.0066	0.0080	0.0154	0.0578	0.0236

SUM: 0.1792

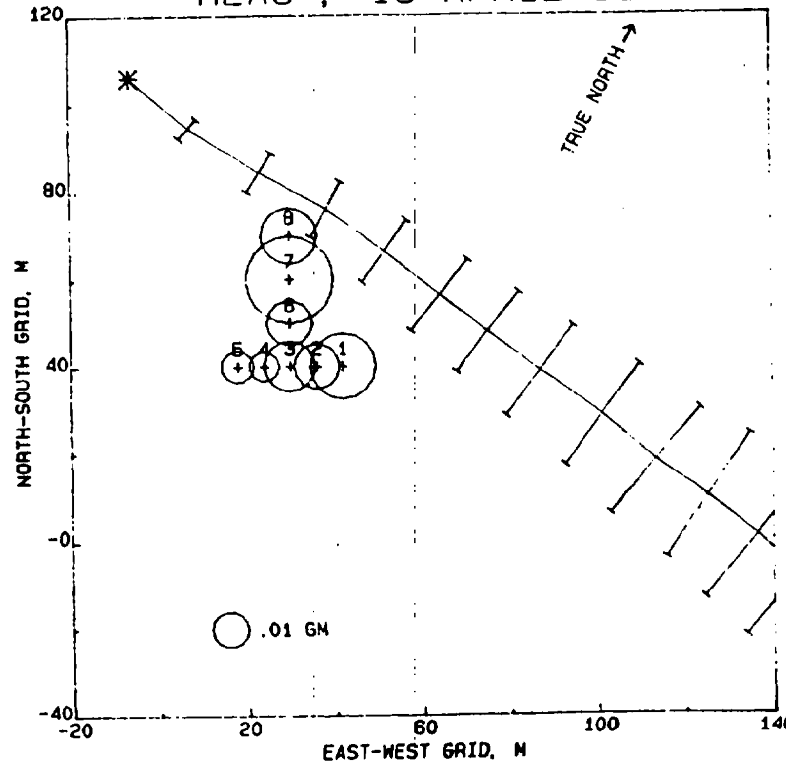
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
4.063	0.000	0.000	0.000

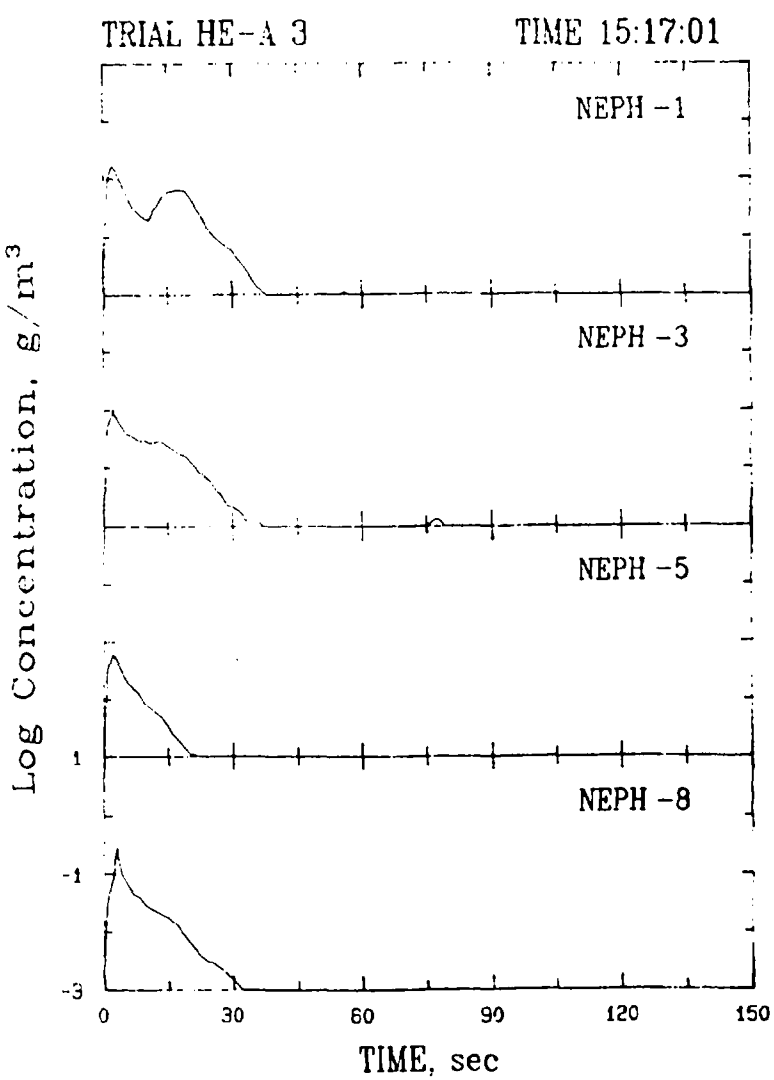
A3 7.5LB 1517HR 19APR83 -6,106

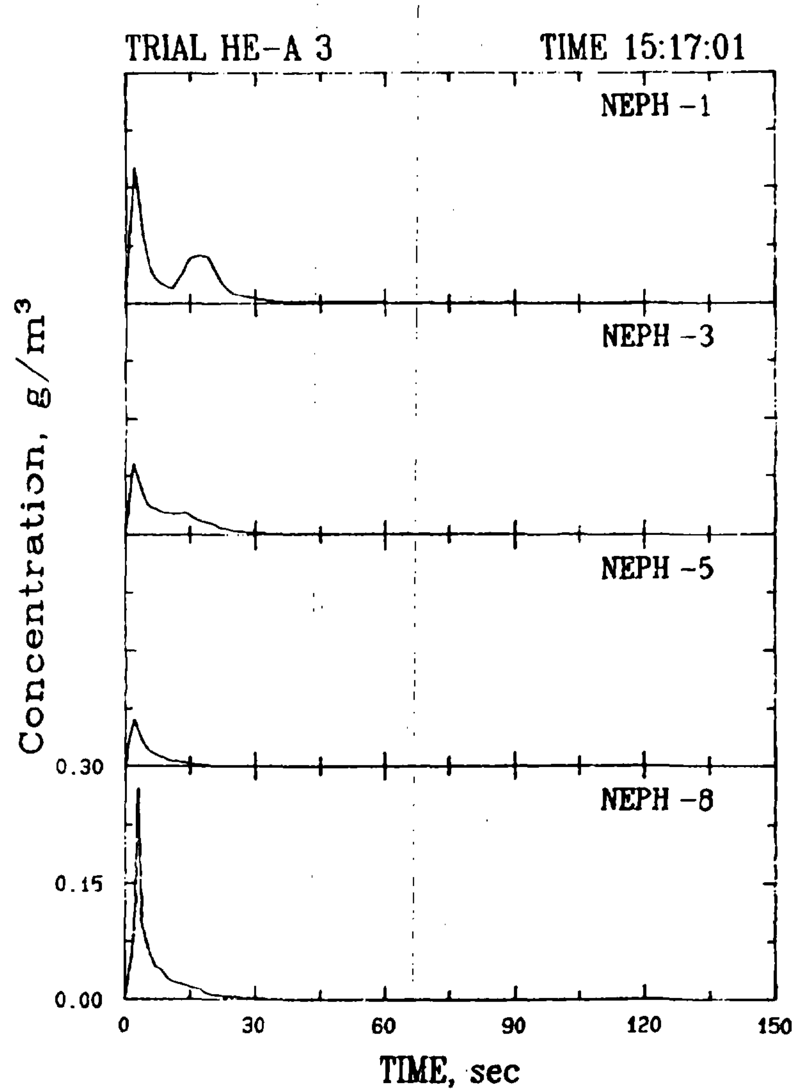


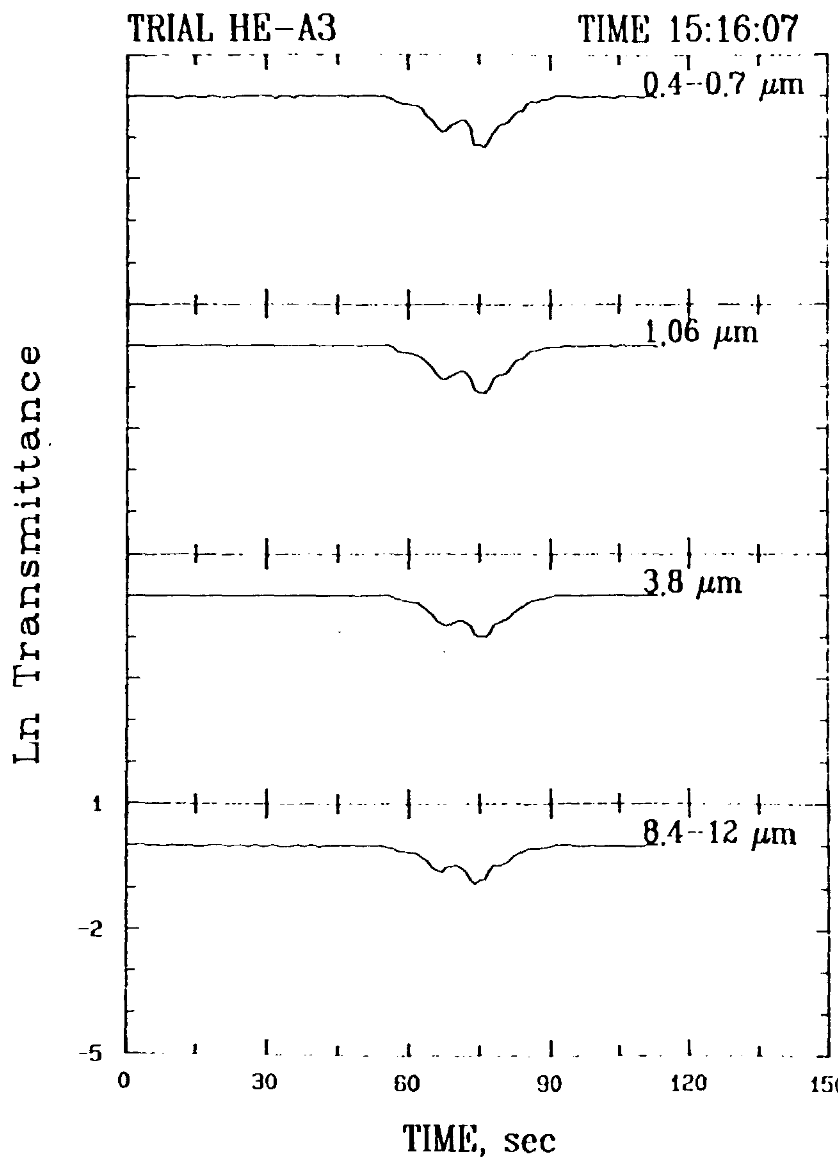
HEA3 , 19 APRIL 83

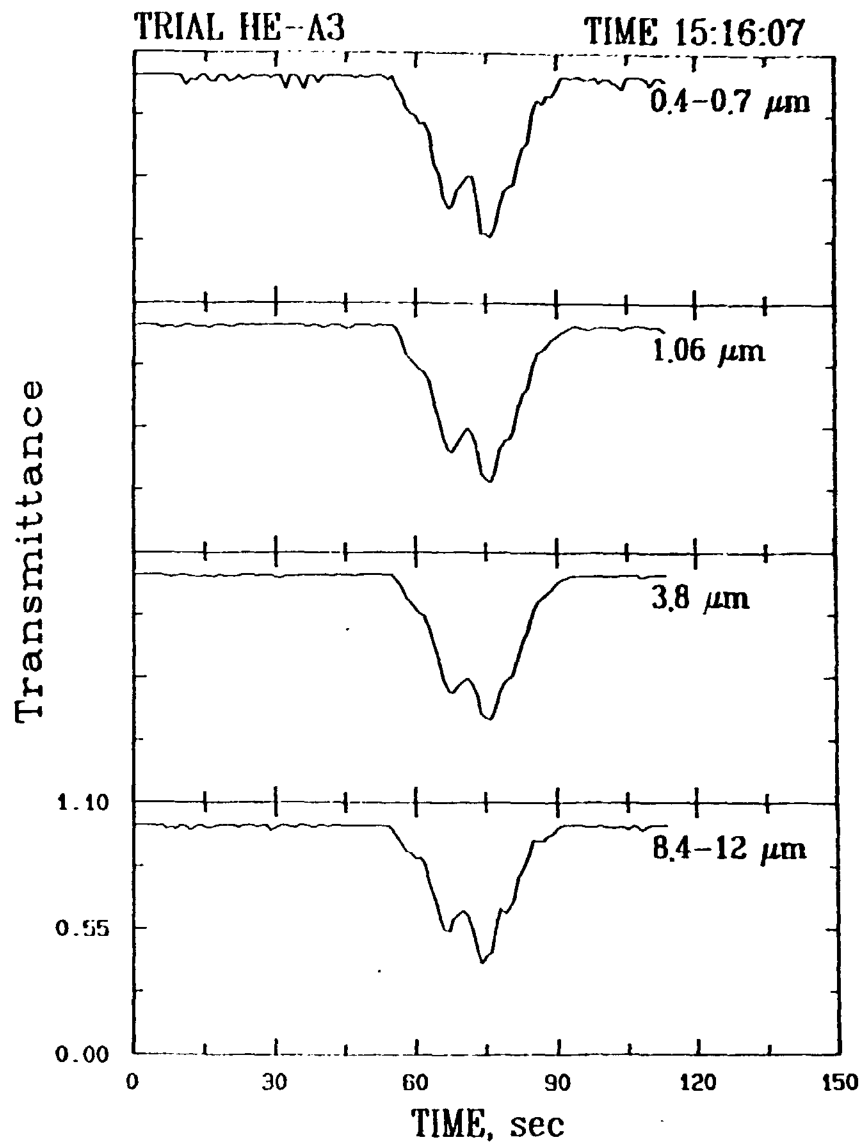


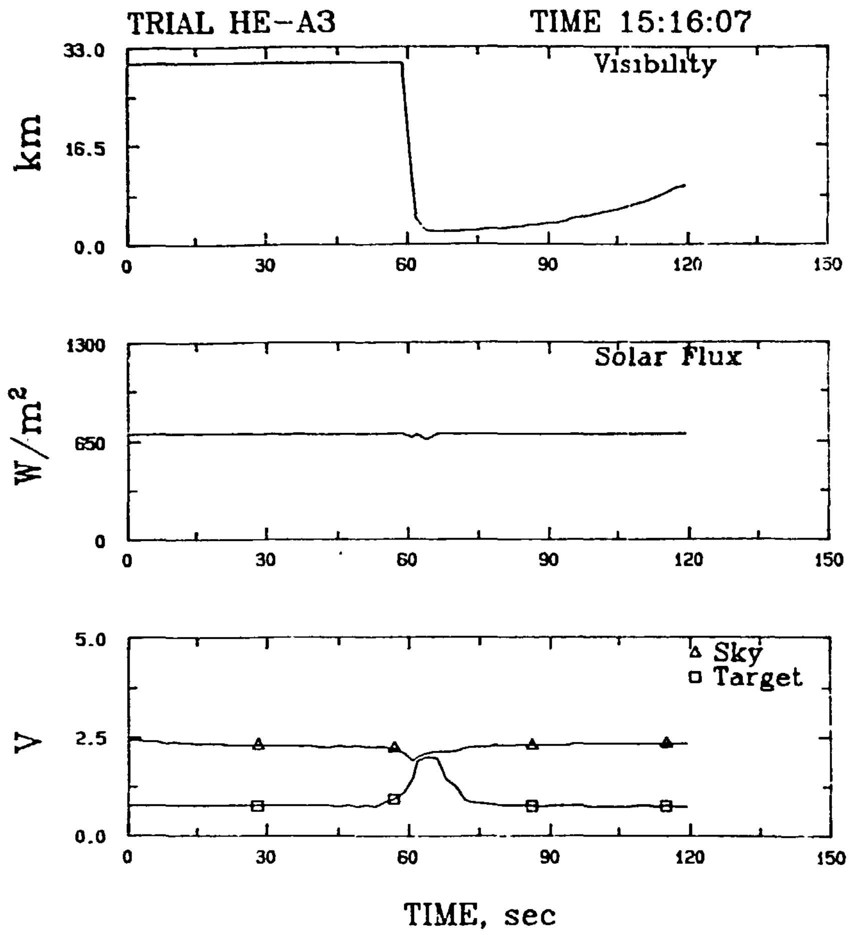
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-A 3
TIME 15:17:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

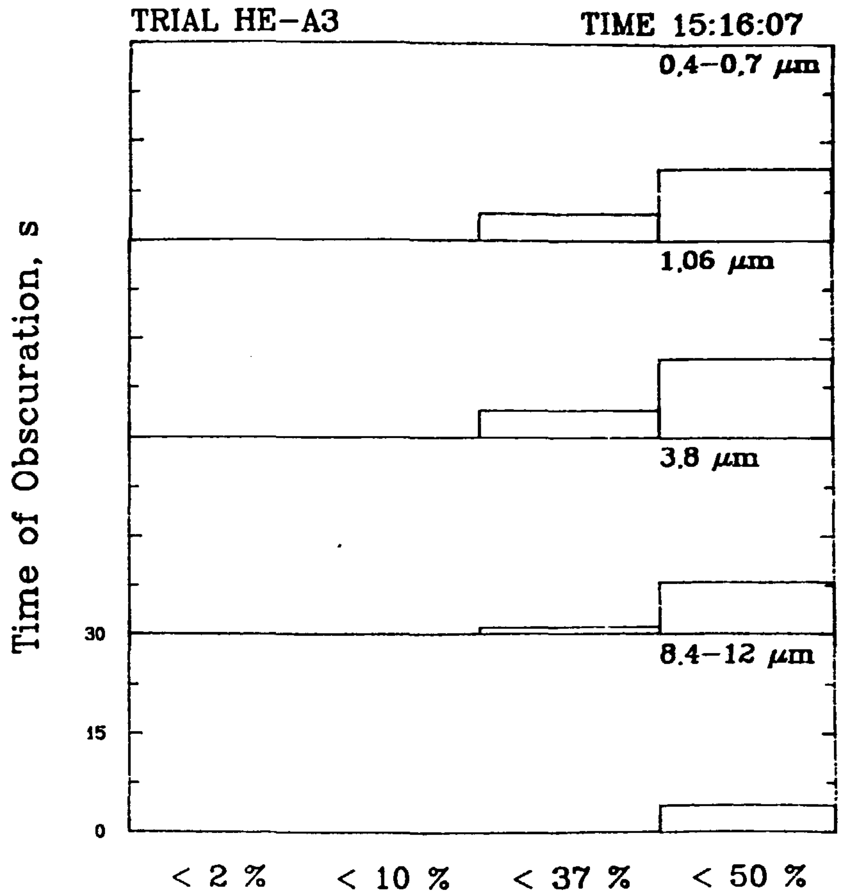

TRIAL HE-A 3
TIME 15:17:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.30
0.15
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A3
TIME 15:16:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A3
TIME 15:16:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A3
TIME 15:16:07
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-A3
TIME 15:16:07
0,4–0,7 μm
1,06 μm
3,8 μm
8,4–12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEA4

Date: 20 APRIL 83
Detonation Coordinates (M):
X: 78.1
Y: 65.1

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 7.5 LB
Event Time: 09:22:01

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -19.806

16 Meter Tower (Means)
Start Time: 9:19:31 End Time: 9:23:43

	2M	4M	6M	16M
Wind Speed (M/S)	3.32	3.41	3.52	3.59
Wind Dir. (DEG)	93.5	91.8	94.9	100.1
Sigma WSP	1.30	1.33	1.39	1.54
Sigma WDIR	19.5	19.8	18.1	14.3
UVW Components				
U (N-S) (M/S)	0.40	0.29	0.45	0.56
V (E-W) (M/S)	-3.14	-3.23	-3.34	-3.45
W (Vert) (M/S)	0.22	0.16	0.24	*
Sigma U	1.02	1.05	1.01	0.83
Sigma V	1.29	1.34	1.39	1.55
Sigma W	0.19	0.29	0.37	*
Temperature (C)	15.5	14.3	13.8	13.5

Soil Temperature (C): 21.2

Dew Point (C): 0.4

Temperature (C): 14.1

Rel. Hum. (%): 39.2

Abs. Hum. (G/M**3): 4.76

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 892.4

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.89
Target: 1.27

Sky-Target Contrast: -0.33

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	75.0	60.0	25	119	458	710
Post-Shot	75.0	60.0	90	130	350	705

CRATER DATA

Moisture Content: 33.3

CRATER VOLUMES (M**3):
True Crater: 0.204
Apparent Crater: 0.110
Flow: 0.094

DENSITIES (G/CM**3):
Pre-Shot: 1.540
Flow: 1.087
Bottom: *
Side: *

HI VOL DATA (G):

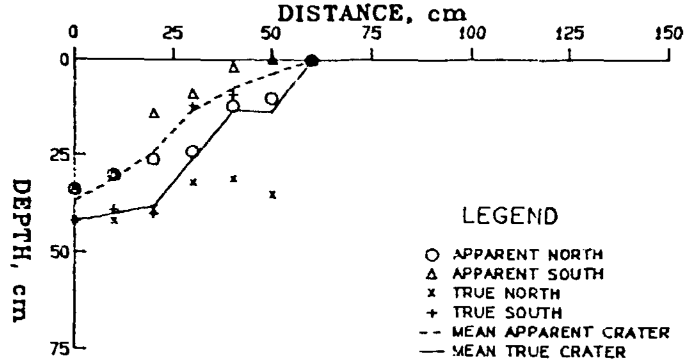
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0166	0.0086	0.0126	0.0183	0.0221	0.0329	0.0302	0.0205

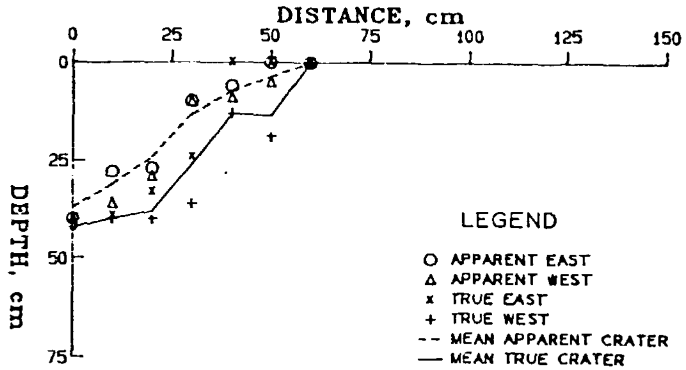
SUM: 0.1618

GELMAN DOSAGE (G S/M**3):

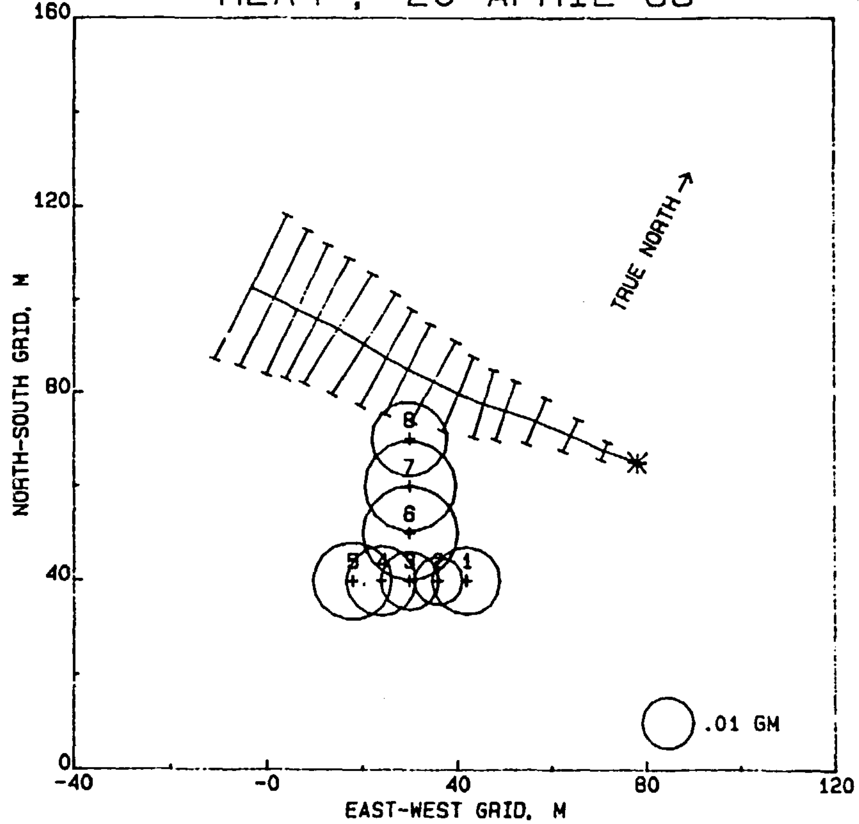
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	1.600	0.000	0.000

A4 7.5LB 0922HR 20APR83 78,65

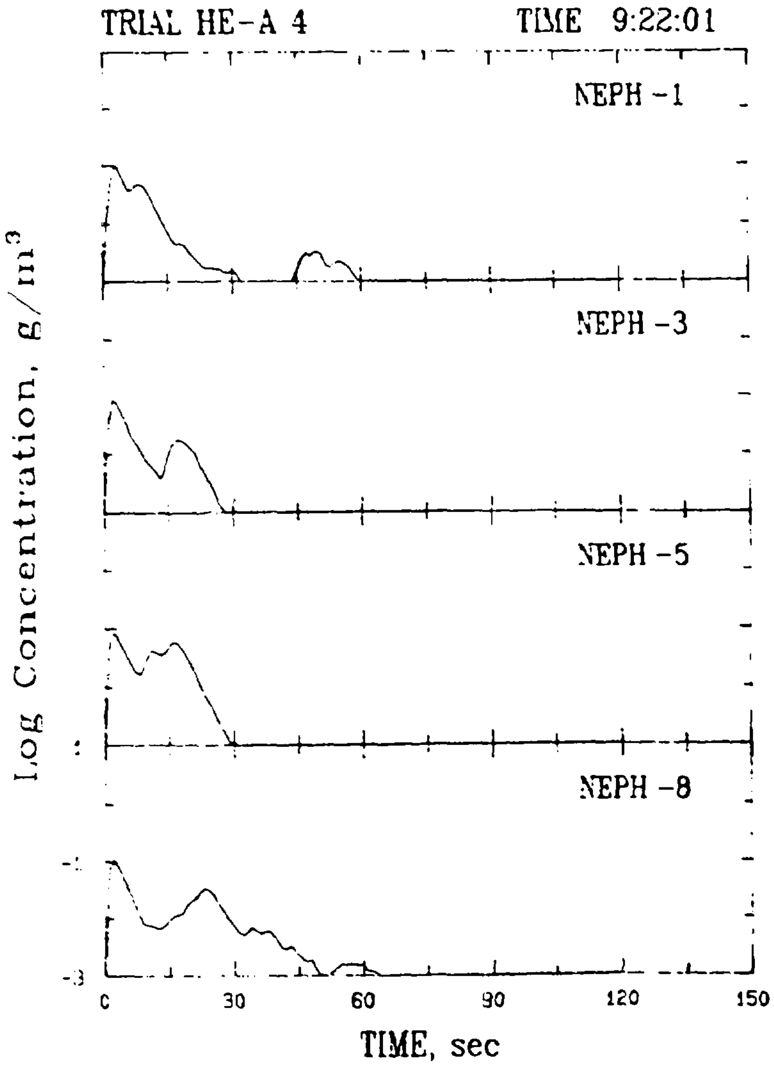


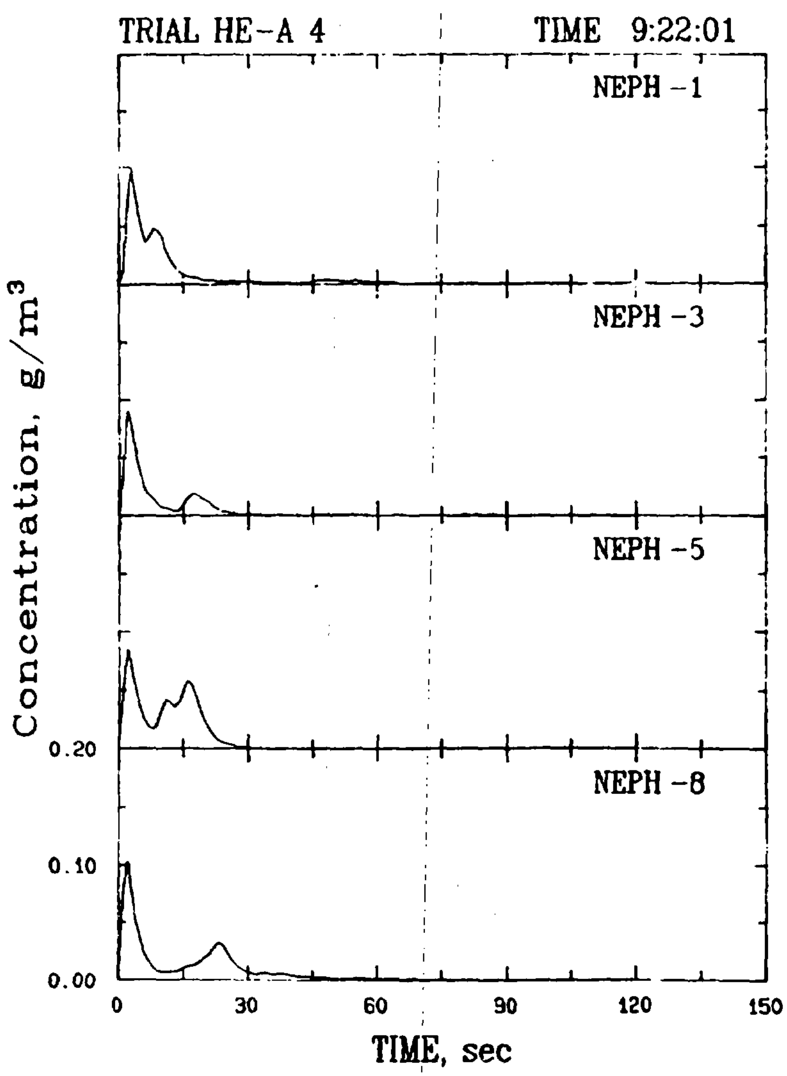


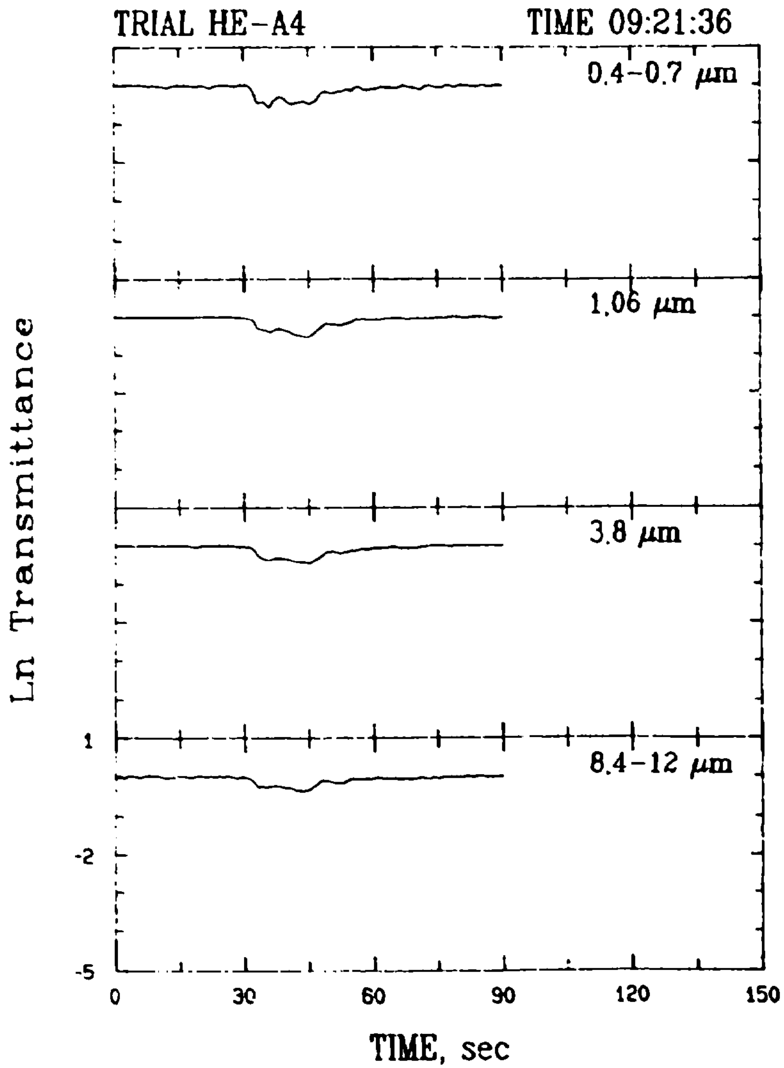
HEA4 , 20 APRIL 83

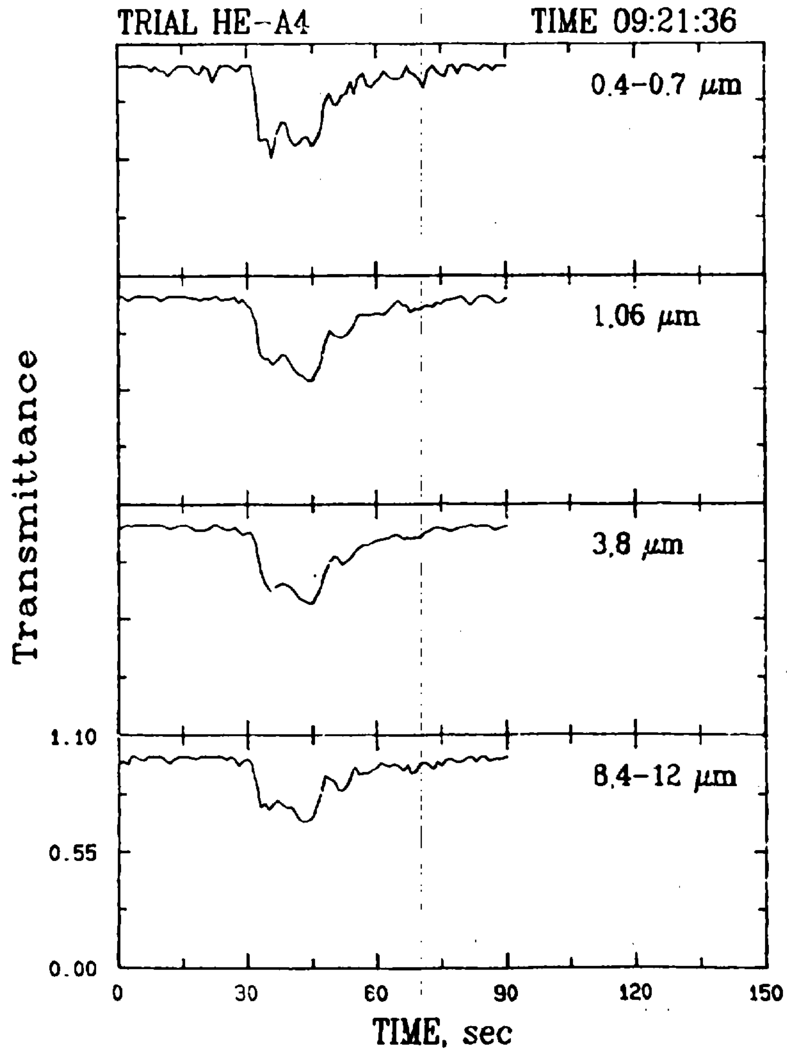


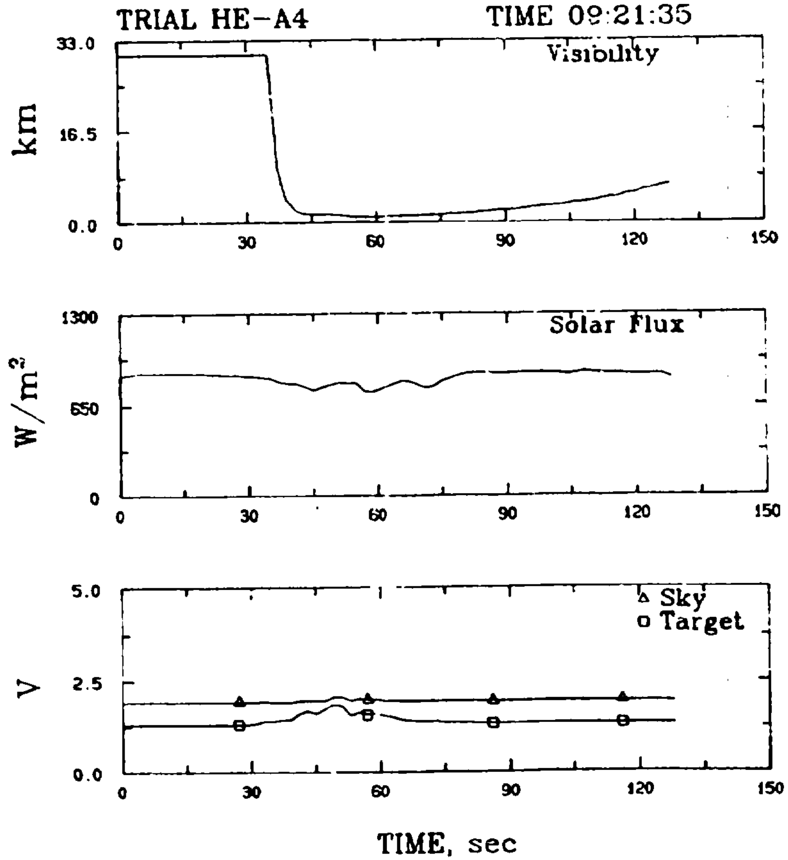
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-A 4
TIME 9:22:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
-3
0
30
60
90
120
150
TIME, sec
Log Concentration, g/m³


TRIAL HE-A 4
TIME 9:22:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
0.20
0.10
0.00
0
30
60
90
120
150
TIME, sec
Concentration, g/m³


TRIAL HE-A4
TIME 09:21:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A4
TIME 09:21:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A4
TIME 09:21:35
Visibility
km
33.0
16.5
0.0
0
30
60
90
120
150
Solar Flux
W/m²
1300
650
0
0
30
60
90
120
150
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEA5

Surface Tangent

Date: 20 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 77.7
Y: 9.0

Charge Wt: 7.5 LB
Event Time: 10:34:01

METEOROLOGICAL DATA:

Pasquill Category: A
Richardson Number: -6.263

16 Meter Tower (Means)
Start Time: 10:34: 4 End Time: 10:36: 2

	2M	4M	6M	16M
Wind Speed (M/S)	2.33	2.41	2.60	2.92
Wind Dir. (DEG)	128.3	125.7	124.7	118.2
Sigma WSP	0.72	0.73	0.84	0.99
Sigma WDIR	29.0	26.1	23.4	15.5
UVW Components				
U (N-S) (M/S)	1.22	1.21	1.29	1.47
V (E-W) (M/S)	-1.69	-1.83	-2.05	-2.41
W (Vert) (M/S)	0.18	0.21	0.16	*
Sigma U	0.93	0.90	0.85	0.96
Sigma V	0.86	0.84	0.95	0.76
Sigma W	0.23	0.30	0.29	*
Temperature (C)	18.1	16.8	16.1	15.7

Soil Temperature (C): 28.0

Solar Flux (W/M**2): 986.4

Dew Point (C): 0.1

Visual Range (M): 30480.0

Temperature (C): 15.9

Vista Ranger Voltages:
Sky: 2.10
Target: 1.35

Rel. Hum. (%): 34.0

Abs. Hum. (G/M**3): 4.63

Sky-Target Contrast: -0.36

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	78.0	5.0	25	255	635	750+
Post-Shot	78.0	5.0	40	212	492	700

CRATER DATA

Moisture Content: 26.7

CRATER VOLUMES (M**3):
True Crater: 0.178
Apparent Crater: 0.095
Flow: 0.083

DENSITIES (G/CM**3):
Pre-Shot: 1.320
Flow: 1.068
Bottom: *
Side: *

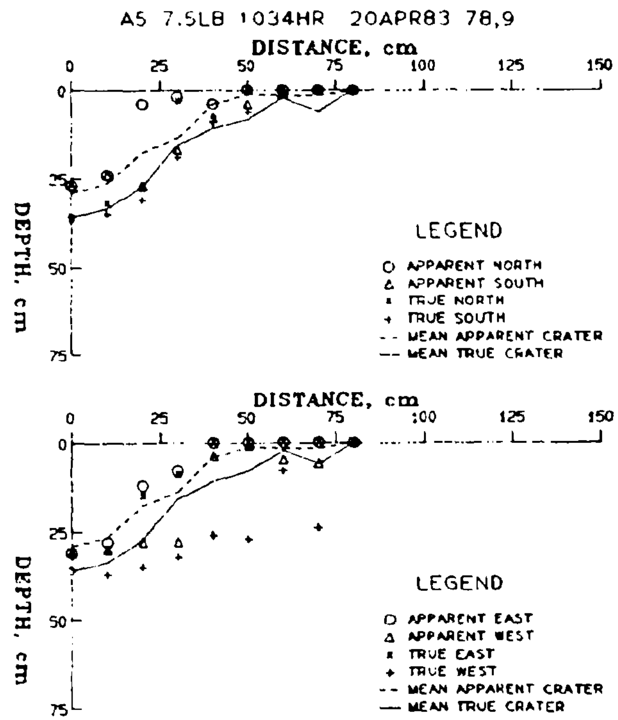
HI VOL DATA (G):

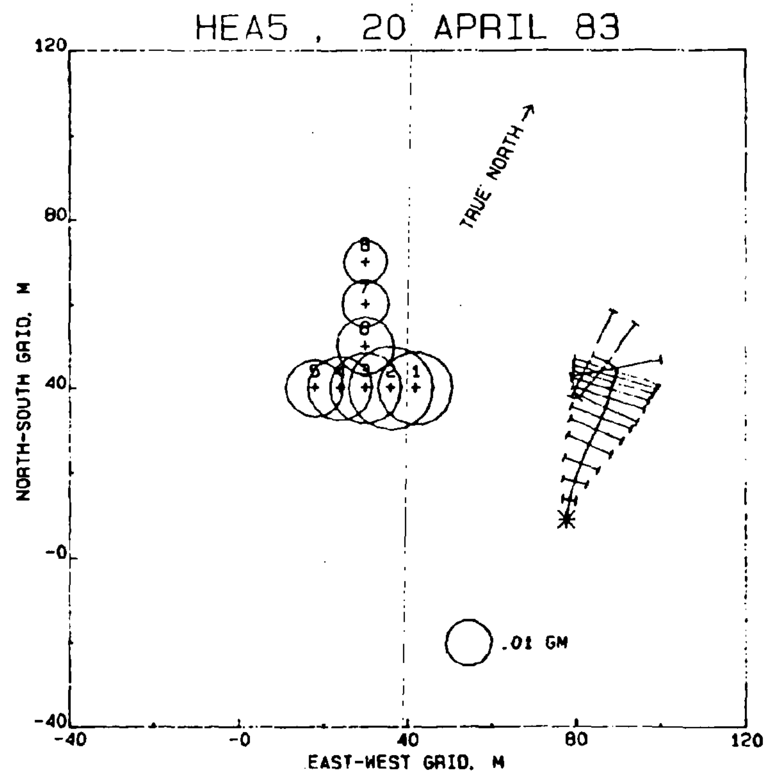
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0260	0.0341	0.0244	0.0198	0.0157	0.0163	0.0108	0.0092

SUM: 0.1563

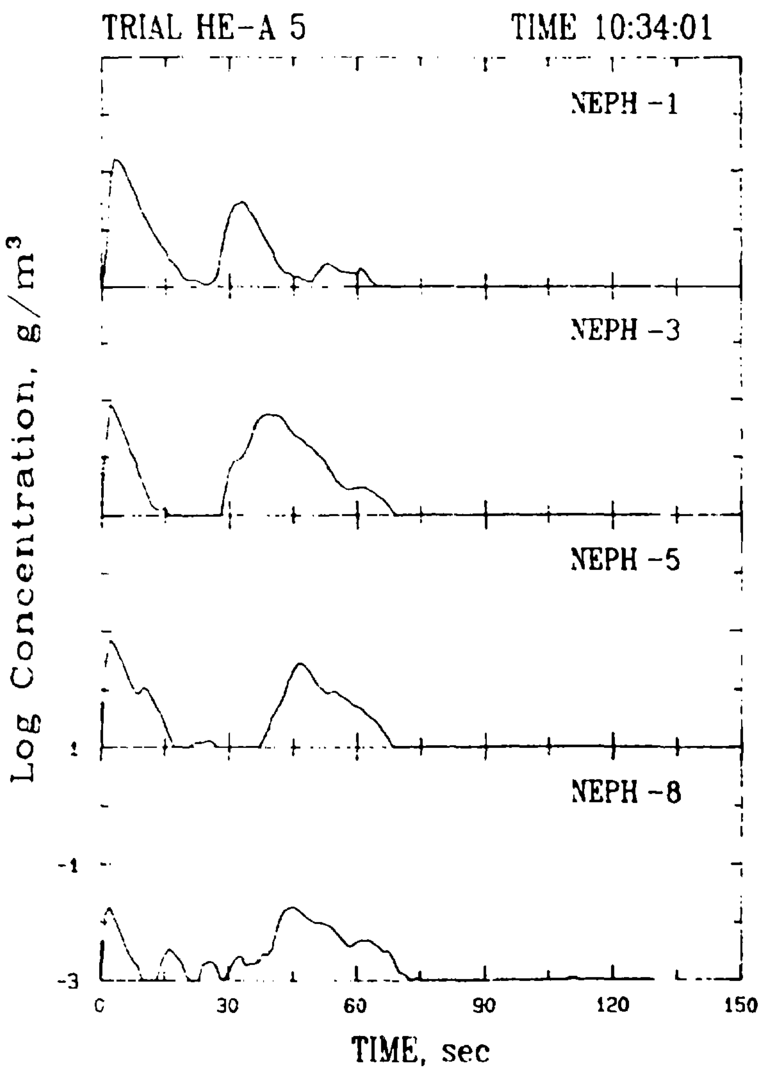
GELMAN DOSAGE (G S/M**3):

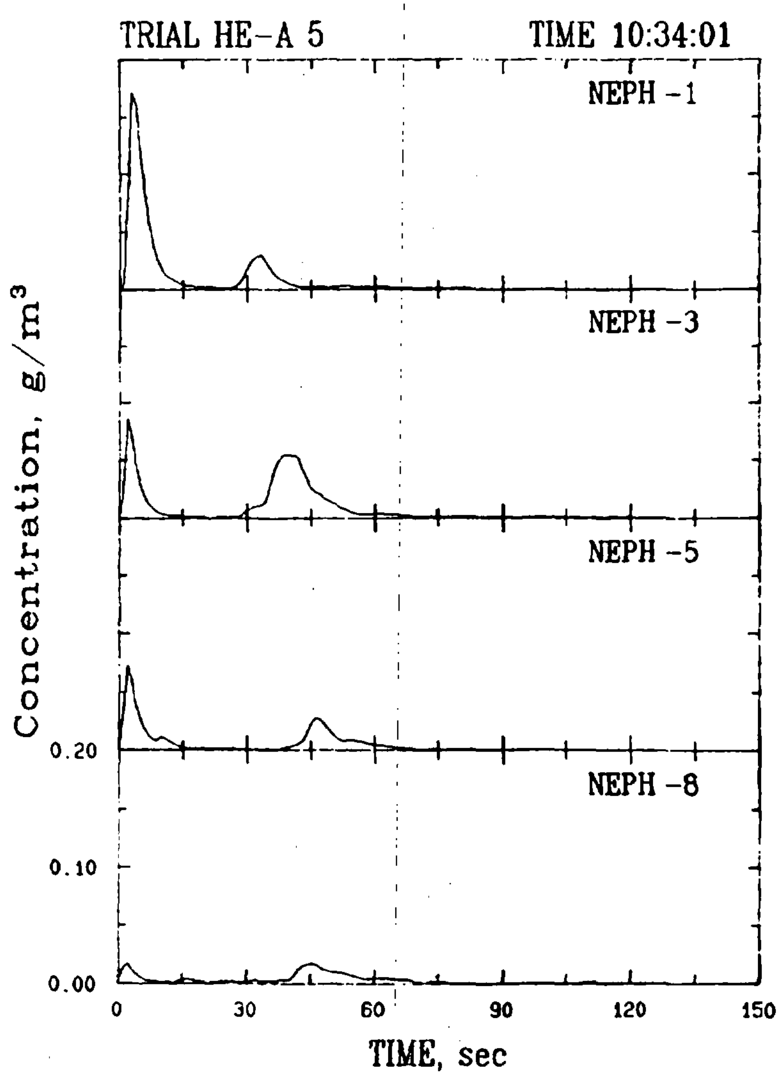
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

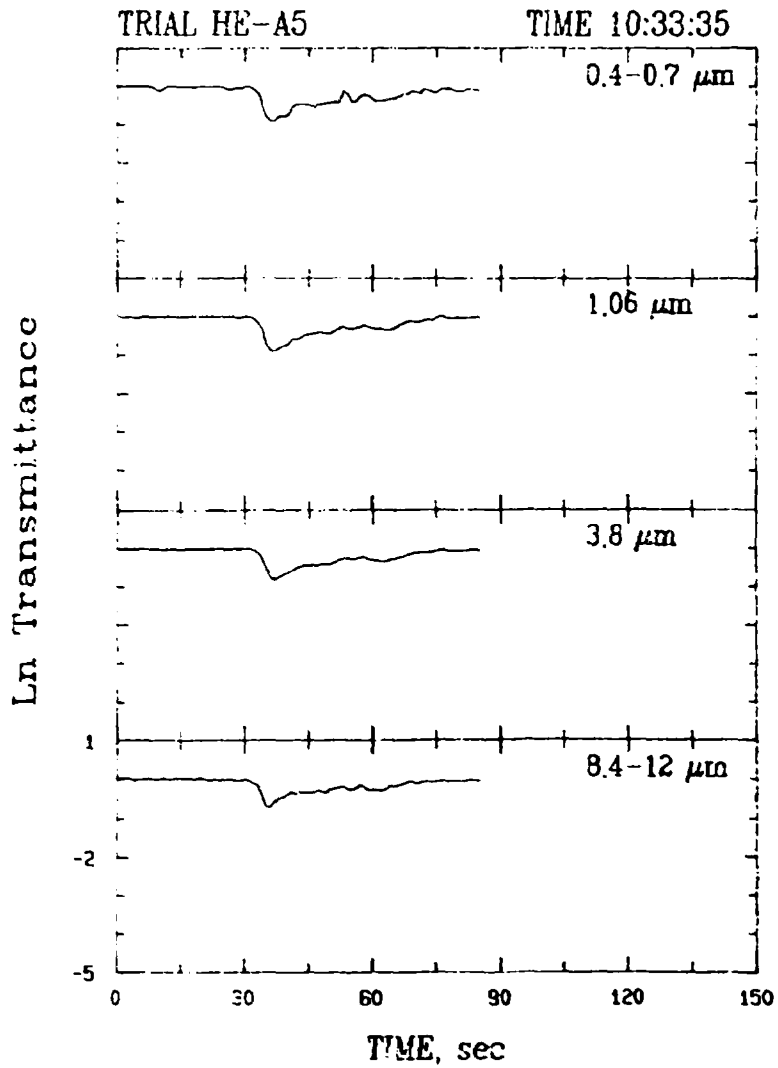


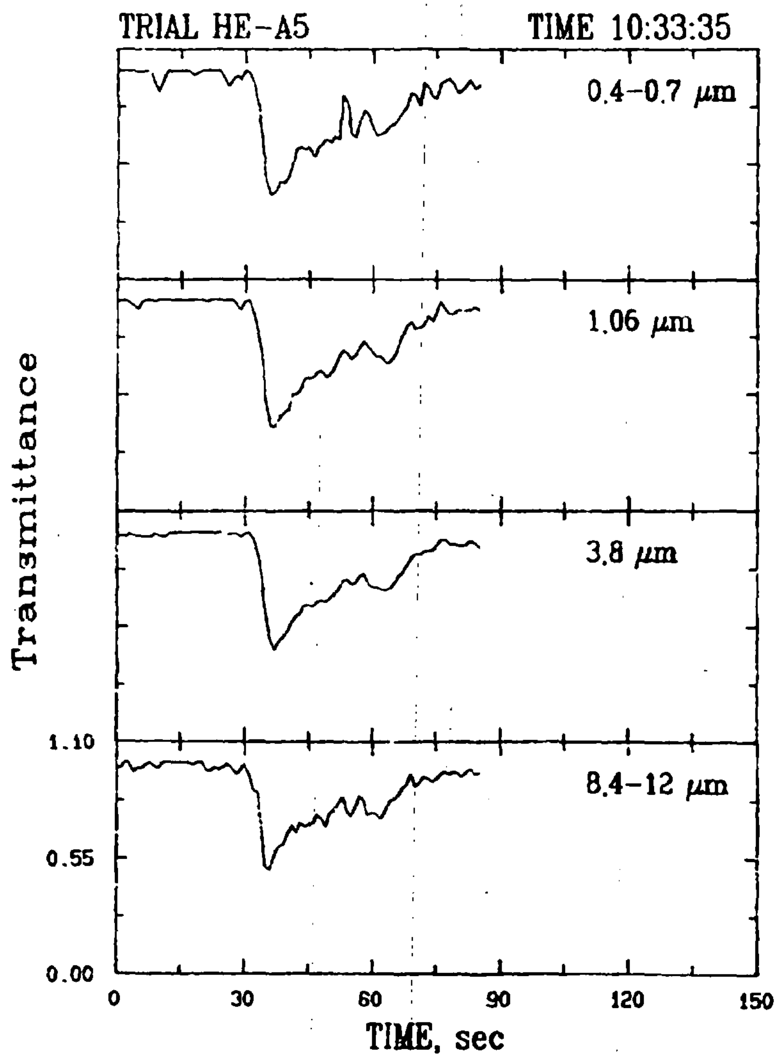


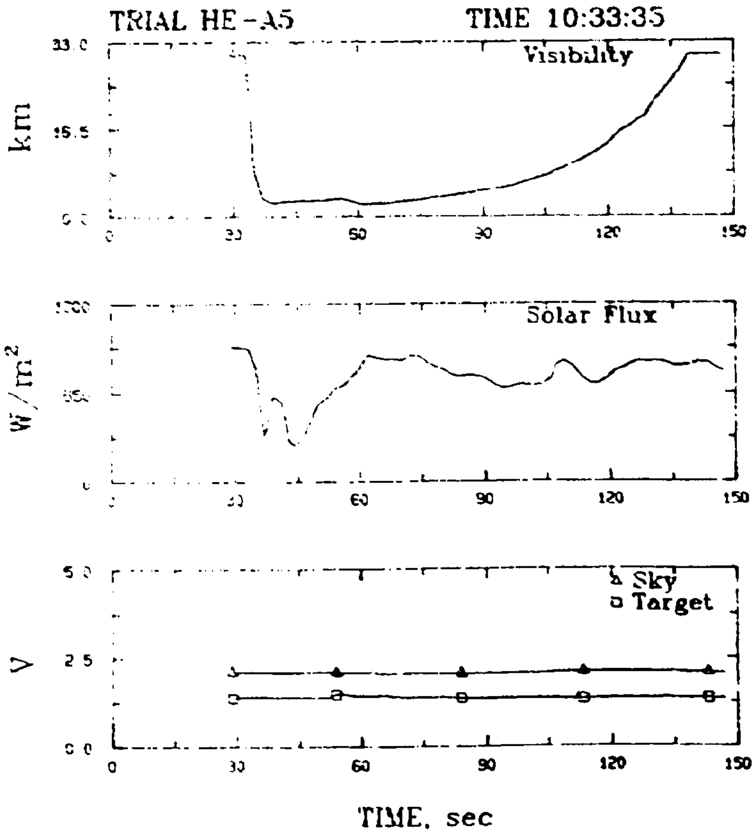
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

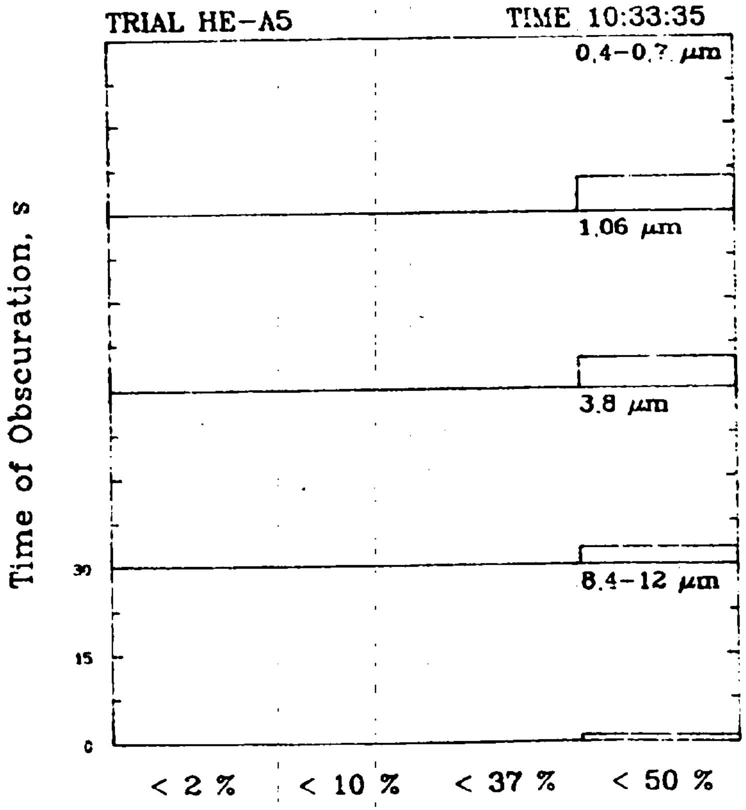

TRIAL HE-A 5
TIME 10:34:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-A 5
TIME 10:34:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.20
0.10
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A5
TIME 10:33:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A5
TIME 10:33:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A5
TIME 10:33:35
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m^2
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec


TRIAL HE-A5
TIME 10:33:35
0.4–0.7 μm
1.06 μm
3.8 μm
8.4–12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEA6

Surface Tangent

Date: 22 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 69.7
Y: 66.3

Charge Wt: 7.5 LB
Event Time: 09:43:31

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.021

16 Meter Tower (Means)
Start Time: 9:39:43   End Time: 9:45:37

	2M	4M	6M	16M
Wind Speed (M/S)	6.29	7.26	7.34	8.95
Wind Dir. (DEG)	31.5	29.2	32.5	27.2
Sigma WSP	0.99	0.99	0.96	0.95
Sigma WDIR	7.5	7.1	8.3	6.2
UVW Components				
U (N-S) (M/S)	-5.34	-6.31	-6.16	-7.94
V (E-W) (M/S)	-3.22	-3.48	-3.86	-4.02
W (Vert) (M/S)	0.44	0.01	0.76	*
Sigma U	1.08	1.11	1.15	1.10
Sigma V	0.68	0.74	0.82	0.79
Sigma W	0.22	0.28	0.29	*
Temperature (C)	10.3	10.1	10.0	9.8

Soil Temperature (C): 11.2

Solar Flux (W/M**2): 205.7

Dew Point (C): 3.5

Visual Range (M): 30480.0

Temperature (C): 9.5

Vista Ranger Voltages:
Sky: 0.54
Target: 0.30

Rel. Hum. (%): 66.0

Abs. Hum. (G/M**3): 6.03

Sky-Target Contrast: -0.43

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	70.0	67.0	25	200	217	300
Post-Shot	70.0	67.0	25	75	108	233

CRATER DATA

Moisture Content: 13.9

CRATER VOLUMES (M**3):
True Crater: 0.383
Apparent Crater: 0.126
Flow: 0.257

DENSITIES (G/CM**3):
Pre-Shot: 1.380
Flow: 1.044
Bottom: 1.011
Side: 1.077

HI VOL DATA (G):

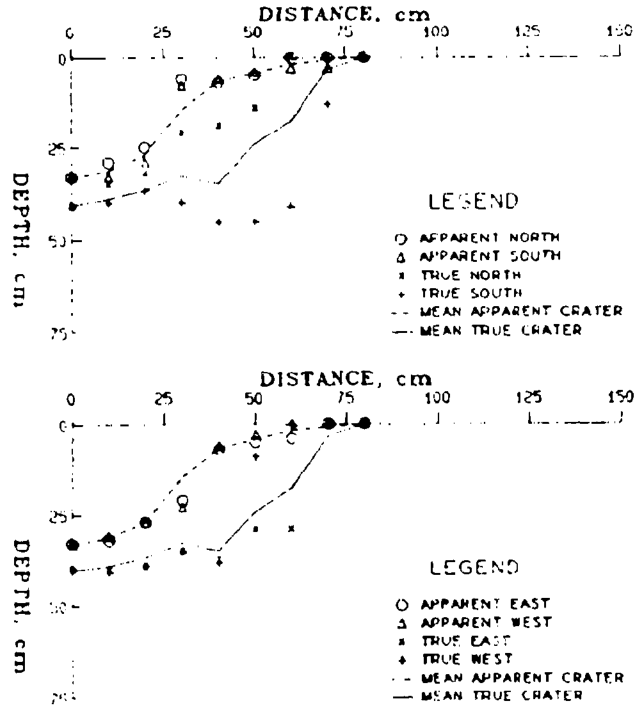
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0062	0.0193	0.0165	0.0457	0.0608	0.0555	0.0032	0.0028

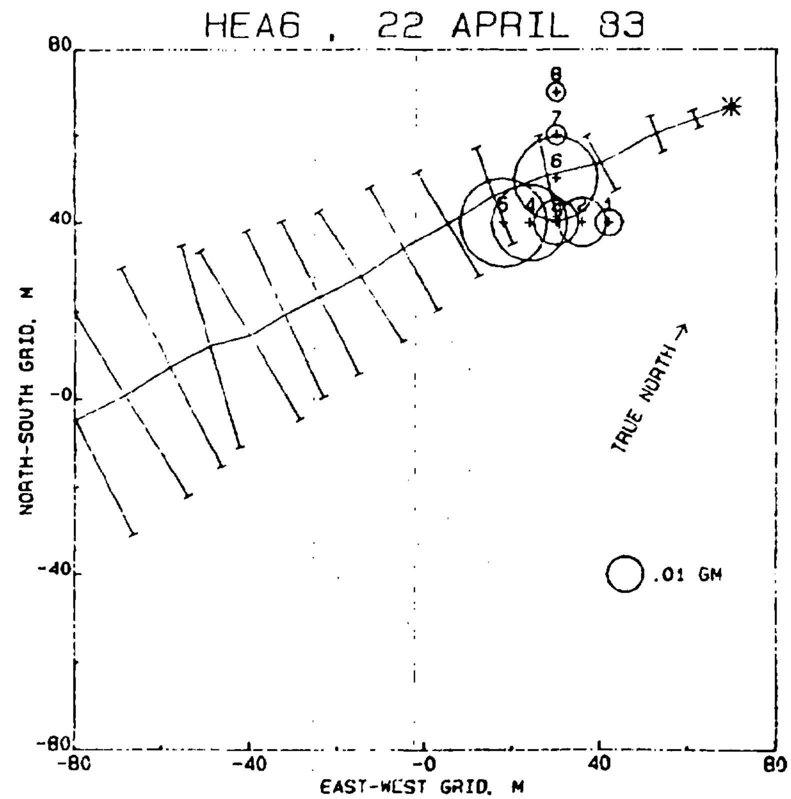
SUM: 0.2100

GELMAN DOSAGE (G S/M**3):

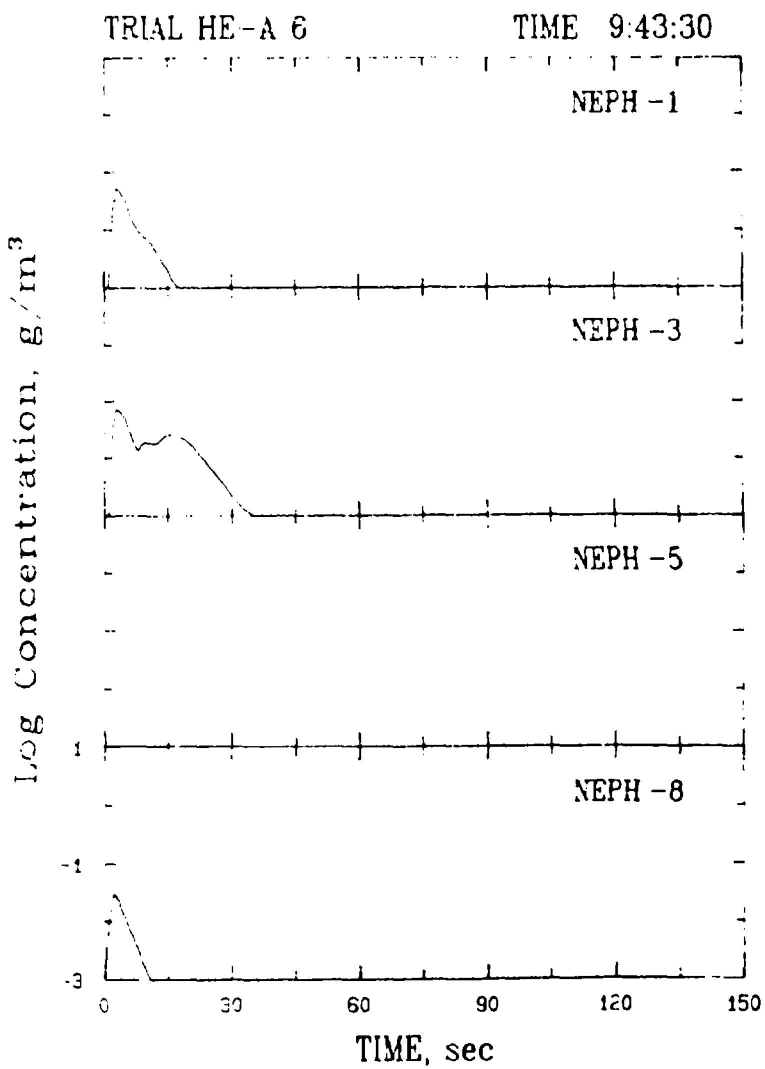
GELMAN A	GELMAN B	GELMAN C	GELMAN D
32.227	65.600	38.854	29.189

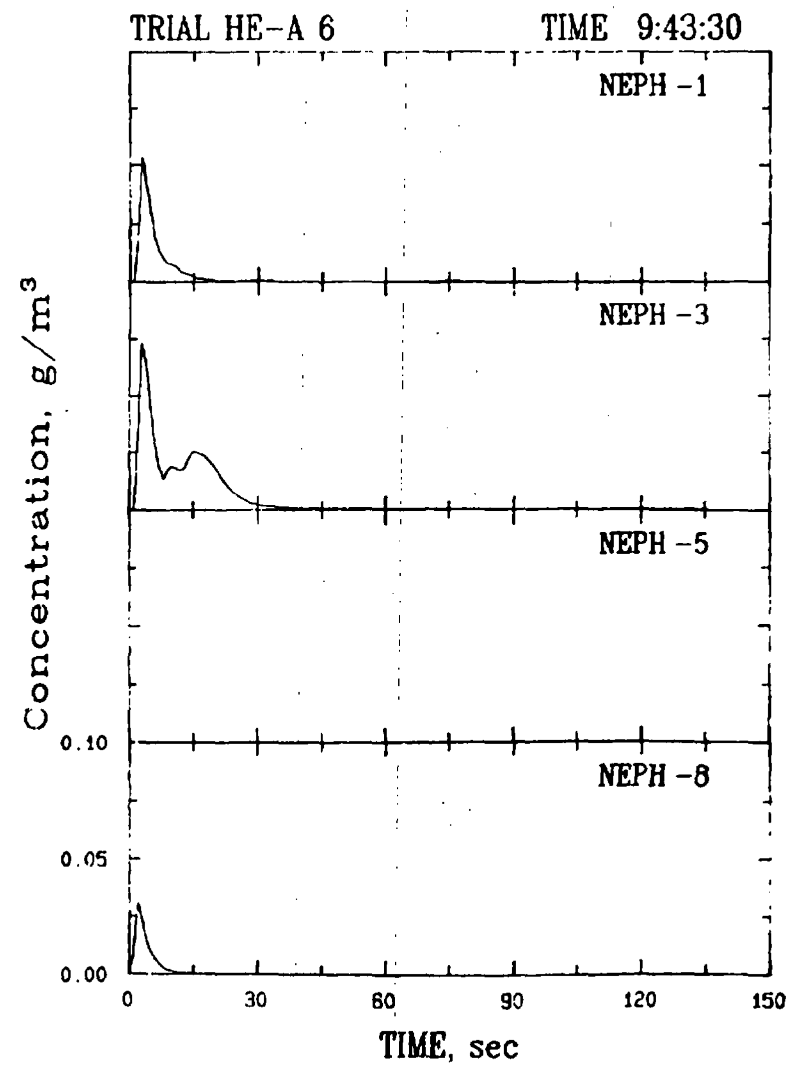
A6 7.5LB 0943HR 22APR83 70,67

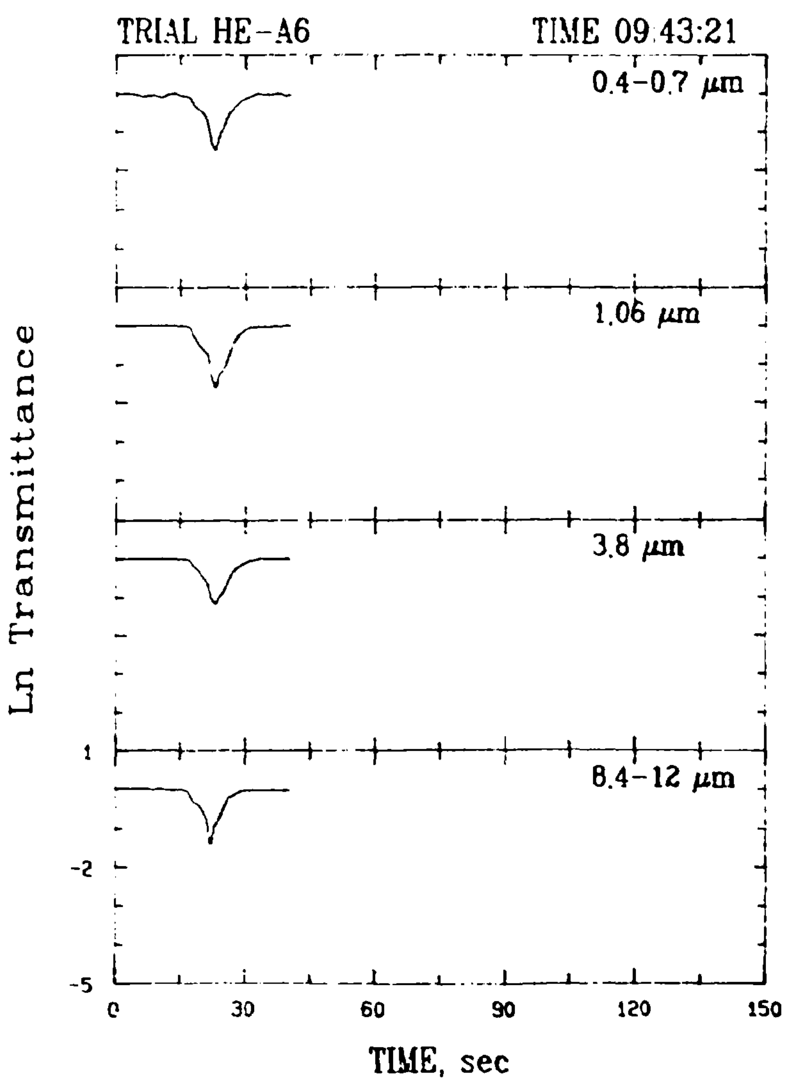




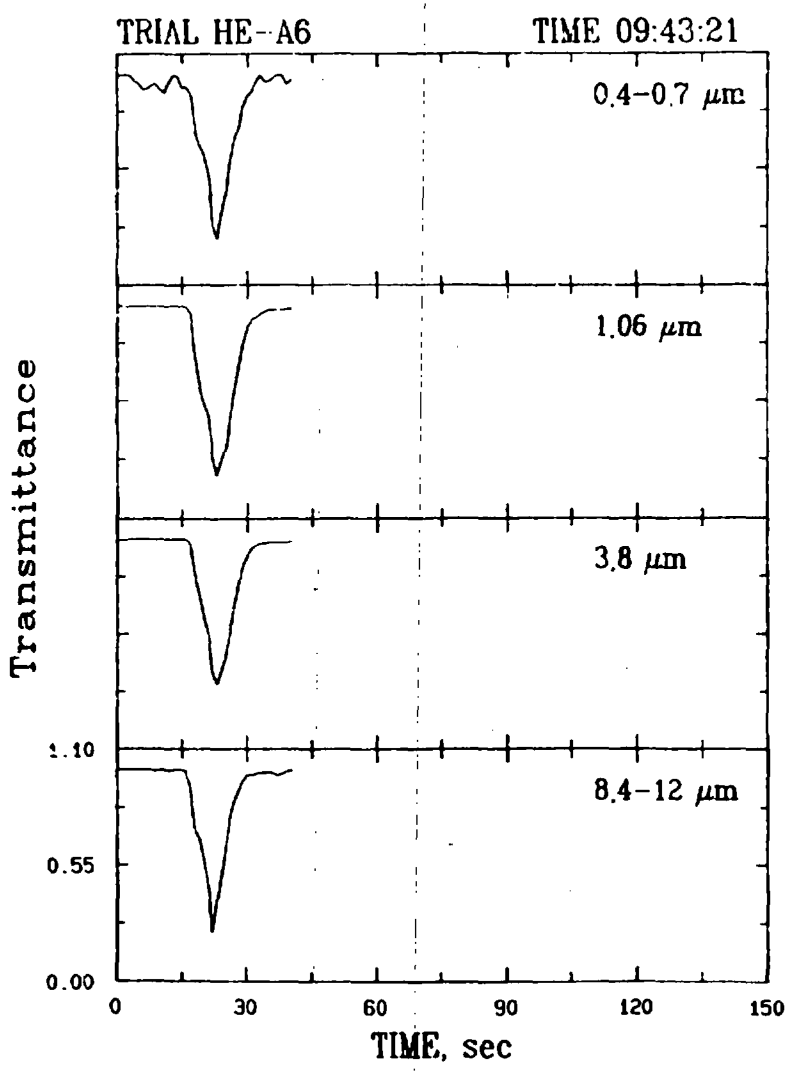
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-A 6
TIME 9:43:30
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

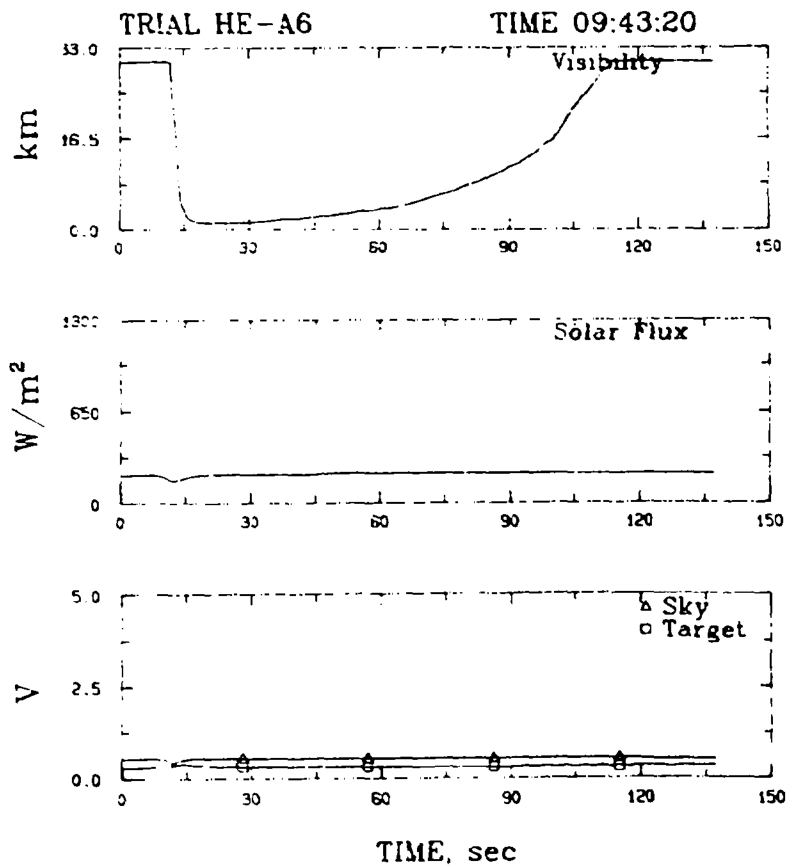

TRIAL HE-A 6
TIME 9:43:30
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.10
0.05
0.00
0
30
60
90
120
150
TIME, sec



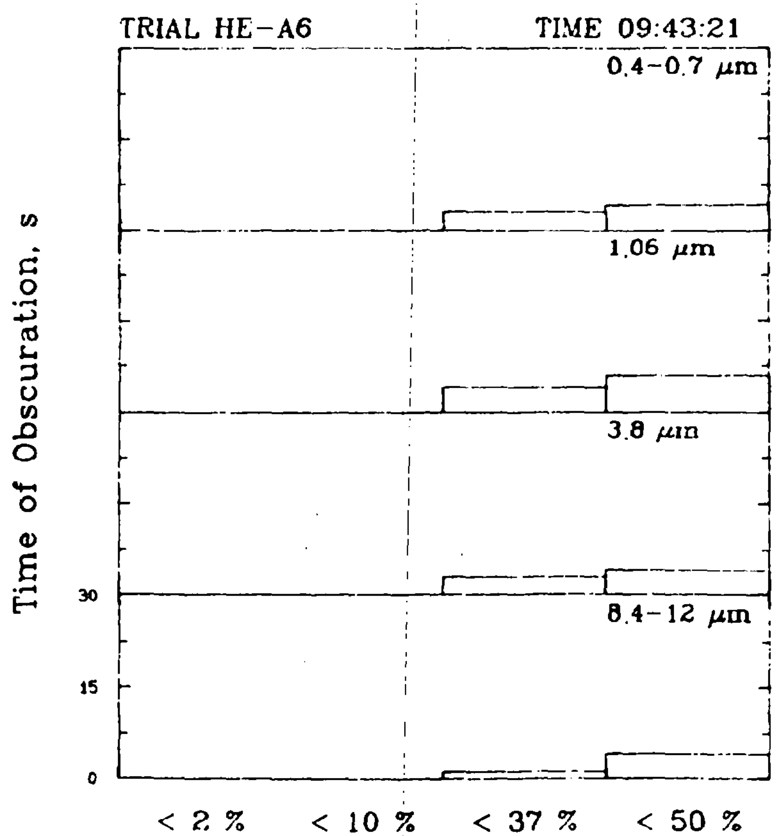
TRIAL HE-A6
TIME 09:43:21
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-A6
TIME 09:43:21
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A6
TIME 09:43:20
Visibility
Solar Flux
Sky
Target
km
W/m²
V
33.0
16.5
0.0
1300
650
0
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-A6
TIME 09:43:21
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number. HEA7

Surface Tangent

Date: 25 APRIL 85

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 7.7
Y: 75.2

Charge Wt: 7.5 LB
Event Time: 09:44:42

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.194

16 Meter Tower (Means)
Start Time: 9:42: 6 End Time: 9:46:44

	2M	4M	6M	16M
Wind Speed (M/S)	5.71	6.22	6.47	6.85
Wind Dir. (DEG)	289.8	288.3	287.0	286.4
Sigma WSP	1.00	0.95	0.95	0.94
Sigma WDIR	12.7	12.4	11.8	10.1
U/V/W Components				
U (N-S) (M/S)	-1.79	-1.80	-1.77	-1.85
V (E-W) (M/S)	5.28	5.80	6.08	6.48
W (Vert) (M/S)	0.09	0.11	0.31	*
Sigma U	1.09	1.15	1.17	1.16
Sigma V	1.16	1.15	1.12	1.03 *
Sigma W	0.20	0.30	0.30	*
Temperature (C)	20.0	19.6	19.3	18.9

Soil Temperature (C): 21.0

Solar Flux (W/M**2): 544.8

Dew Point (C): -9.5

Visual Range (M): 30400.0

Temperature (C): 19.0

Vista Ranger Voltages:
Sky: 1.81
Target: 0.99

Rel. Hum. (%): 12.3

Abs. Hum. (G/M**3): 2.02

Sky-Target Contrast: -0.45

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	24.0	88.0	88	330	485	750+
Post-Shot	8.0	75.0	75	410	715	750+

CRATER DATA

Moisture Content: 13.0

CRATER VOLUMES (M**3):
True Crater: 0.378
Apparent Crater: 0.140
Flow: 0.238

DENSITIES (G/CM**3):
Pre-Shot: 1.380
Flow: *
Bottom: *
Side: *

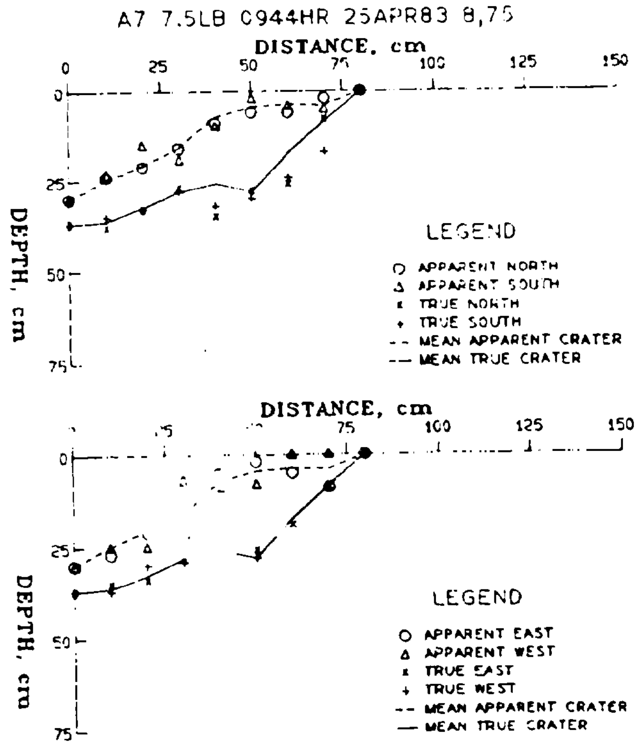
HI VOL DATA (G):

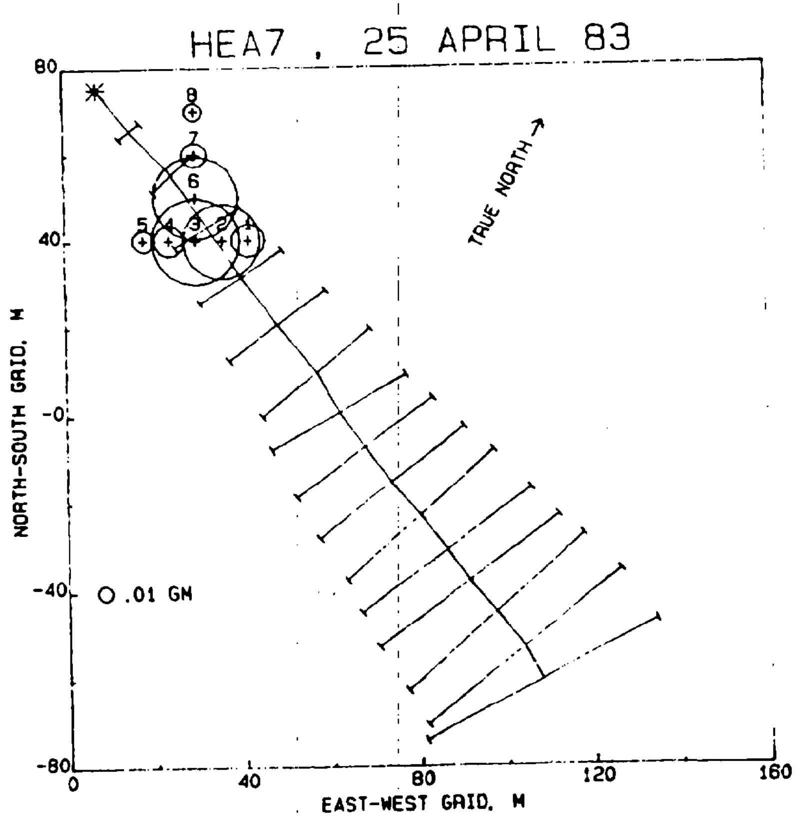
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0437	0.2330	0.3071	0.0394	0.0218	0.2851	0.0243	0.0122

SUM: 0.9666

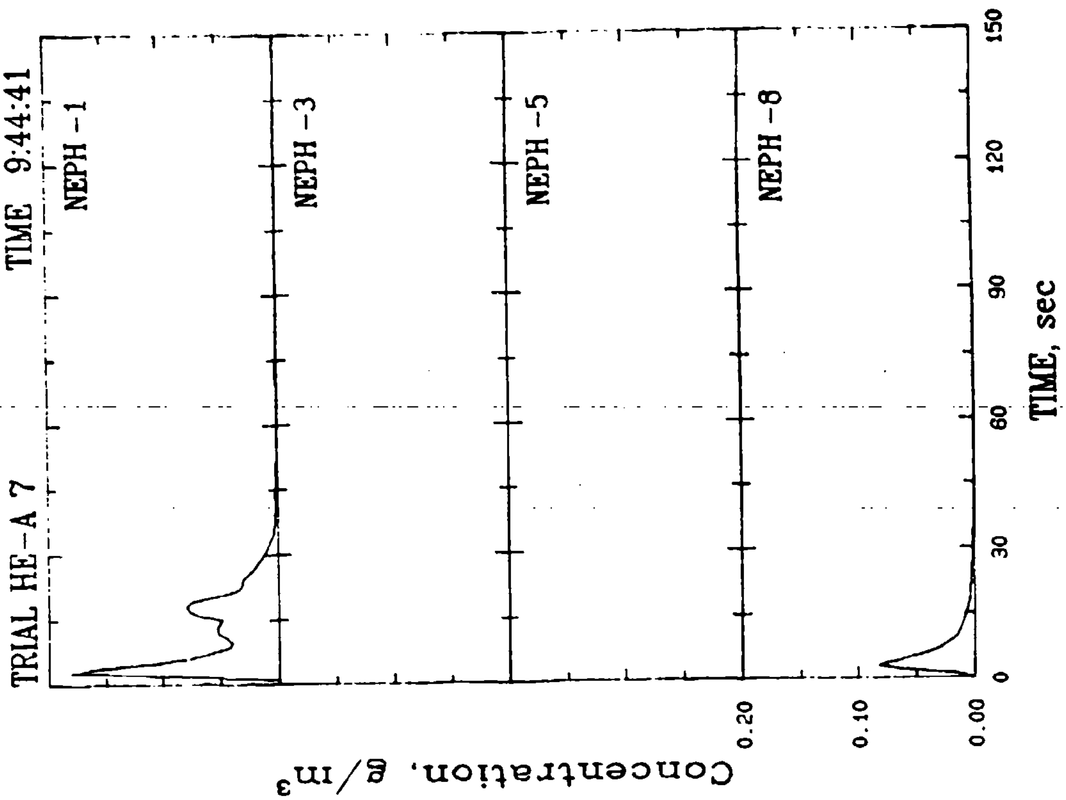
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

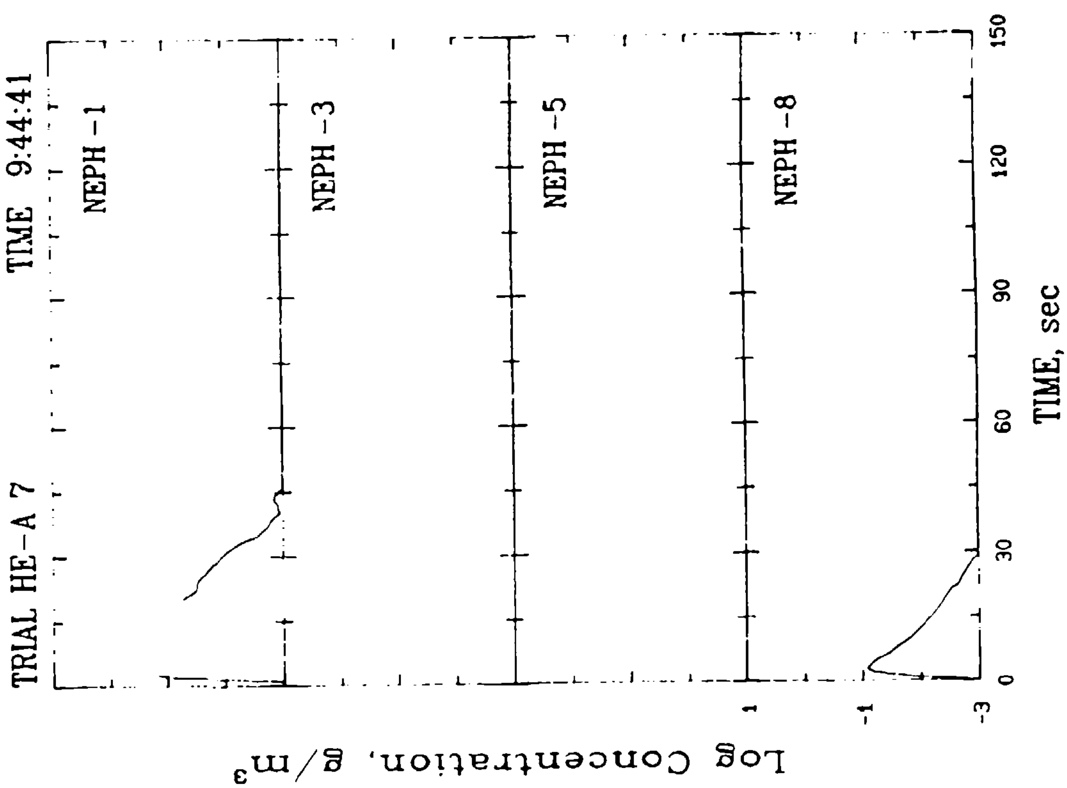




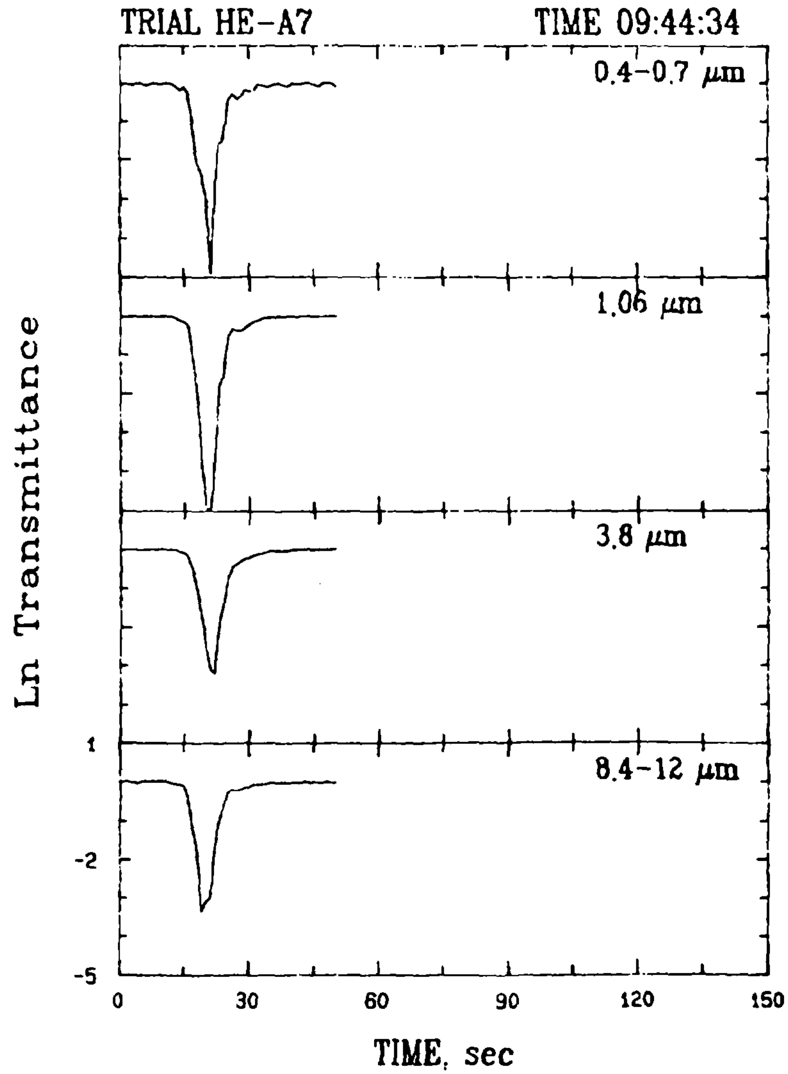
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

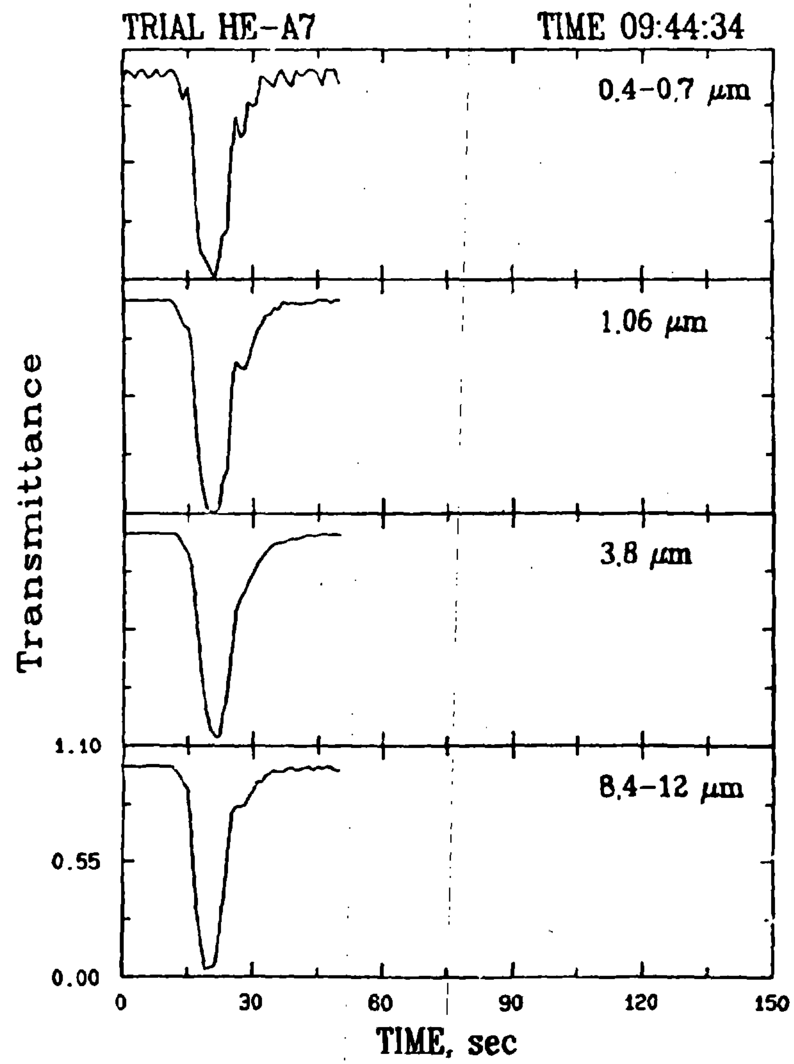


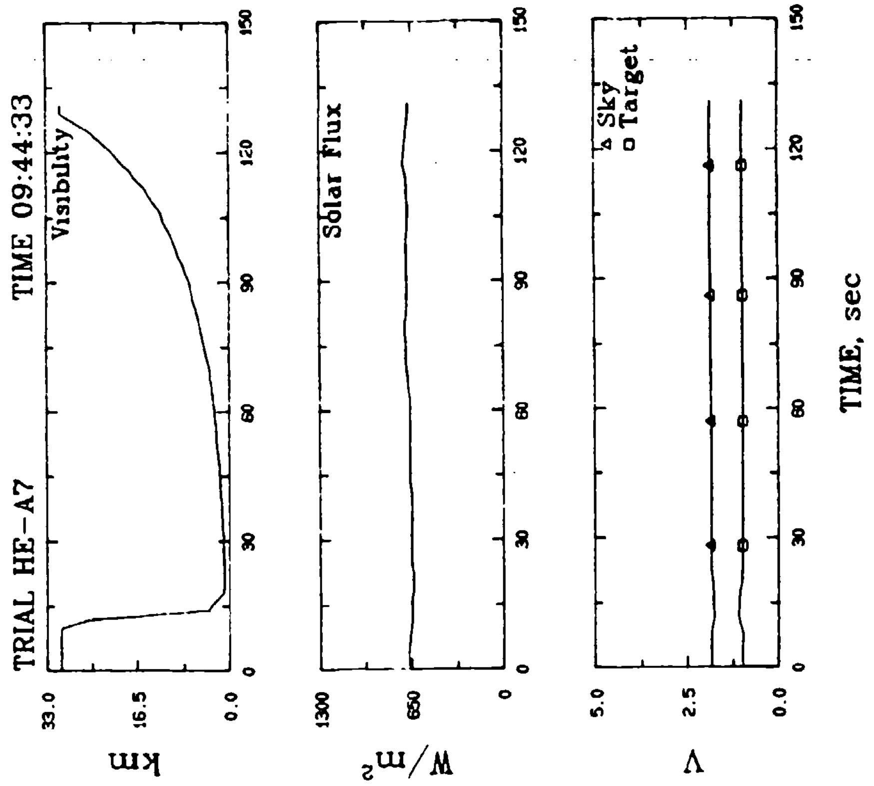
TRIAL HE-A 7
TIME 9:44:41
NEPH -1
NEPH -3
NEPH -5
NEPH -8
0.20
0.10
0.00
Concentration, g/m³
0
30
60
90
120
150
TIME, sec



TRIAL HE-A 7
TIME 9:44:41
NEPH -1
NEPH -3
NEPH -5
NEPH -8
1
-1
-3
Log Concentration, g/m³
0
30
60
90
120
150
TIME, sec


TRIAL HE-A7
TIME 09:44:34
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A7
TIME 09:44:34
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A7
TIME 09:44:33
Visibility
Solar Flux
Sky
Target
km
W/m²
V
33.0
16.5
0.0
1300
650
0
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEA8

Surface Tangent

Date: 25 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 0.9
Y: 63.5

Charge Wt: 7.5 LB
Event Time: 11:10:00

METEOROLOGICAL DATA:

Pasquill Category: A
Richardson Number: -0.688

16 Meter Tower (Means)
Start Time: 11: 2: 8 End Time: 11:11: 1

	2M	4M	6M	16M
Wind Speed (M/S)	3.11	3.22	3.41	3.68
Wind Dir. (DEG)	112.0	113.0	114.0	117.6
Sigma WSP	1.26	1.27	1.28	1.26
Sigma WDIR	31.2	30.7	29.4	31.7
UVW Components				
U (N-S) (M/S)	1.26	1.33	1.41	1.58
V (E-W) (M/S)	-2.51	-2.58	-2.74	-2.82
W (Vert) (M/S)	0.14	0.12	0.09	*
Sigma U	1.34	1.44	1.46	1.66
Sigma V	1.24	1.23	1.29	1.40
Sigma W	0.26	0.37	0.46	*
Temperature (C)	21.4	20.3	19.9	19.6

Soil Temperature (C): 30.9

Solar Flux (W/M**2): 883.6

Dew Point (C): -9.9

Visual Range (M): 30480.0

Temperature (C): 19.9

Vista Ranger Voltages:
Sky: 1.91
Target: 1.02

Rel. Hum. (%): 11.3

Abs. Hum. (G/M**3): 1.95

Sky-Target Contrast: -0.46

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	0.9 63.5	60	255	290	540
Post-Shot	0.9 63.5	25	145	260	305

CRATER DATA

Moisture Content: 11.4

CRATER VOLUMES (M**3):
True Crater: 0.161
Apparent Crater: 0.107
Flow: 0.531

DENSITIES (G/CM**3):
Pre-Shot: 1.360
Flow: *
Bottom: *
Side: *

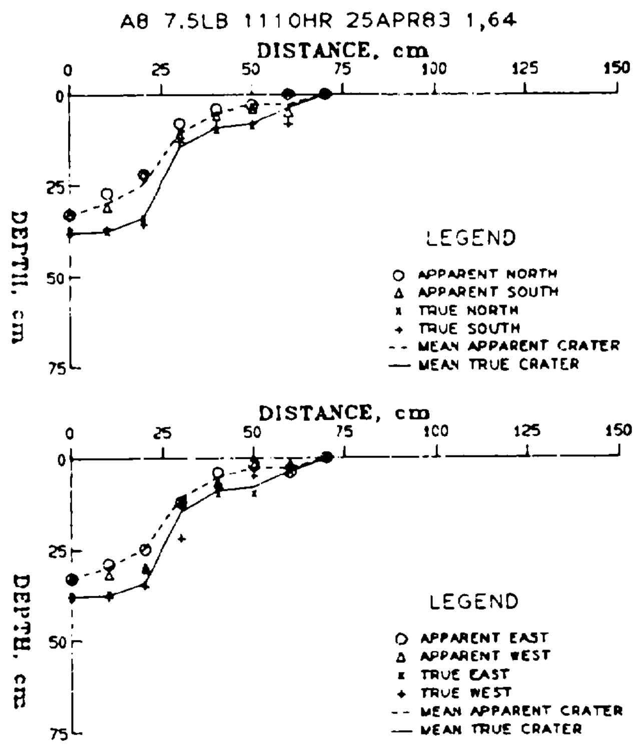
HI VOL DATA (G):

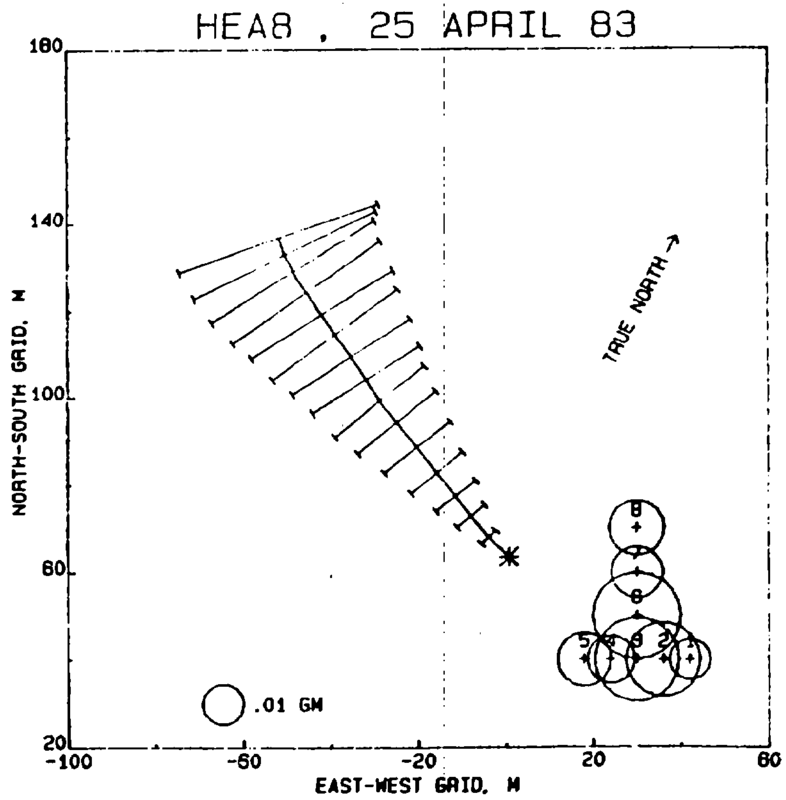
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0103	0.0335	0.0437	0.0145	0.0178	0.0472	0.0165	0.0188

SUM: 0.2023

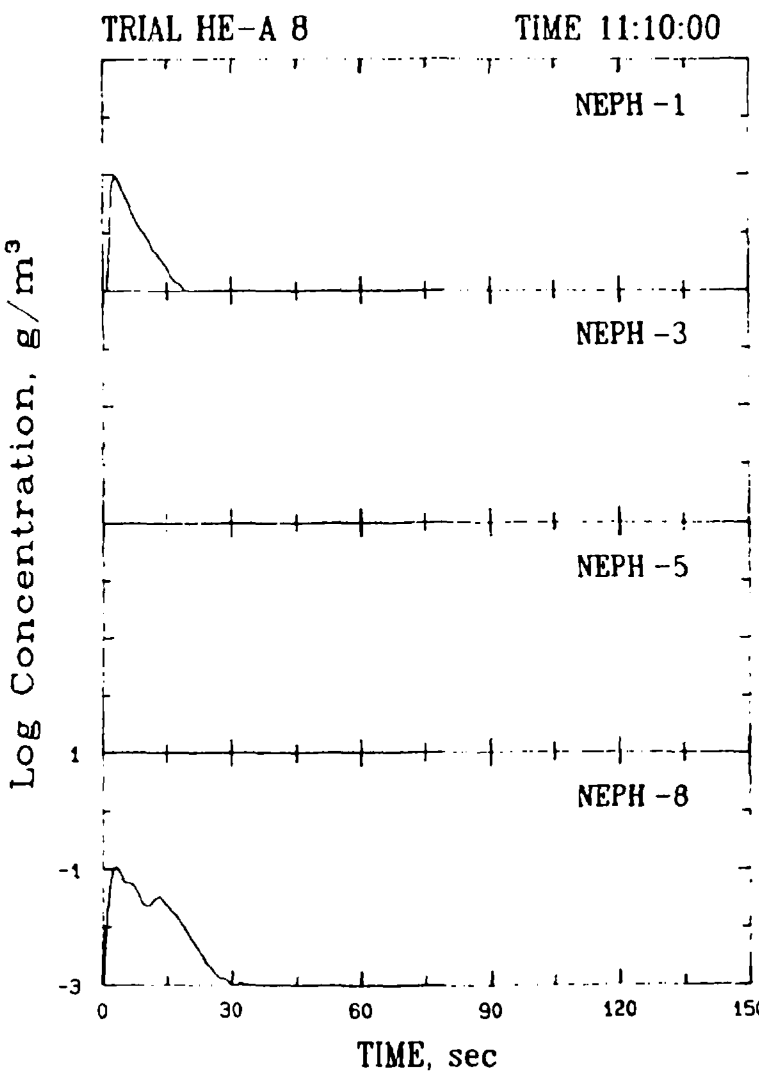
GELMAN DOSAGE (G S/M**3):

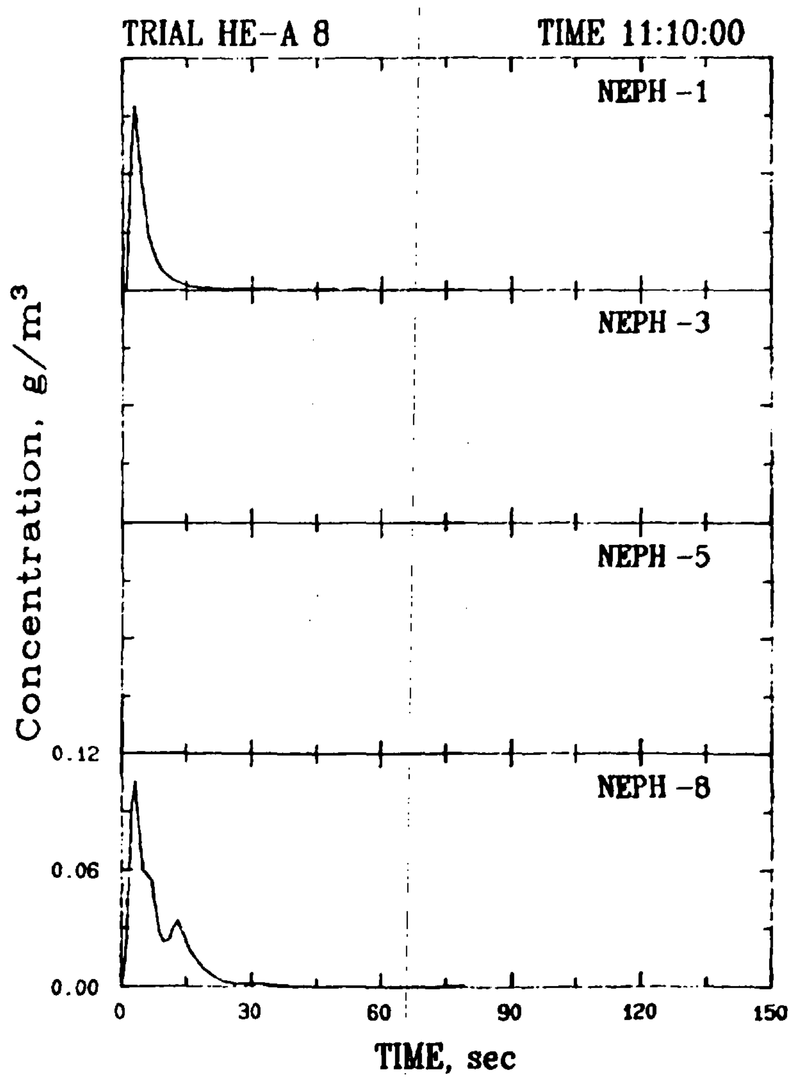
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

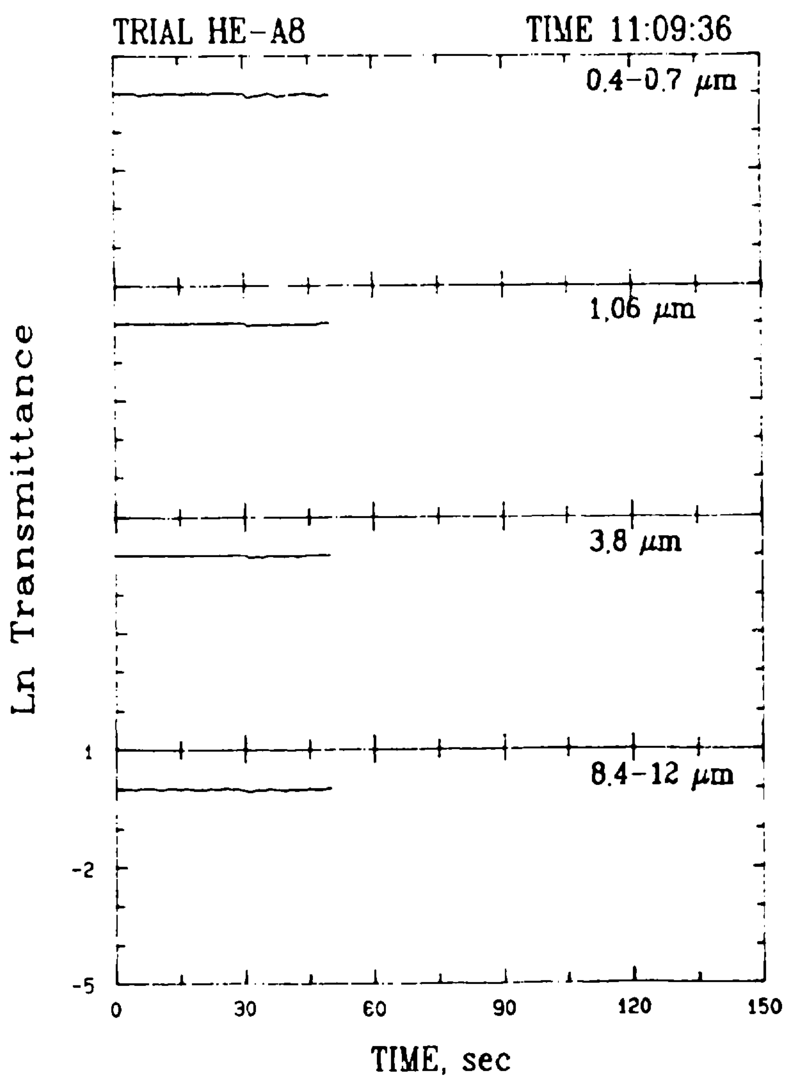


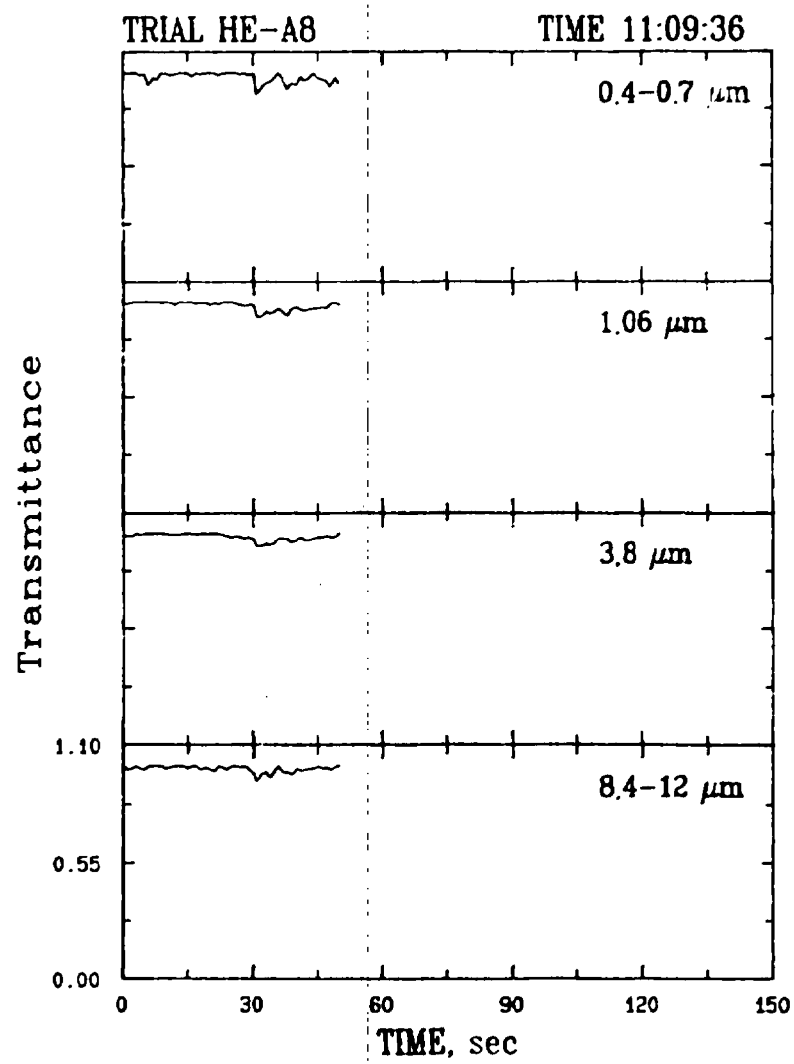


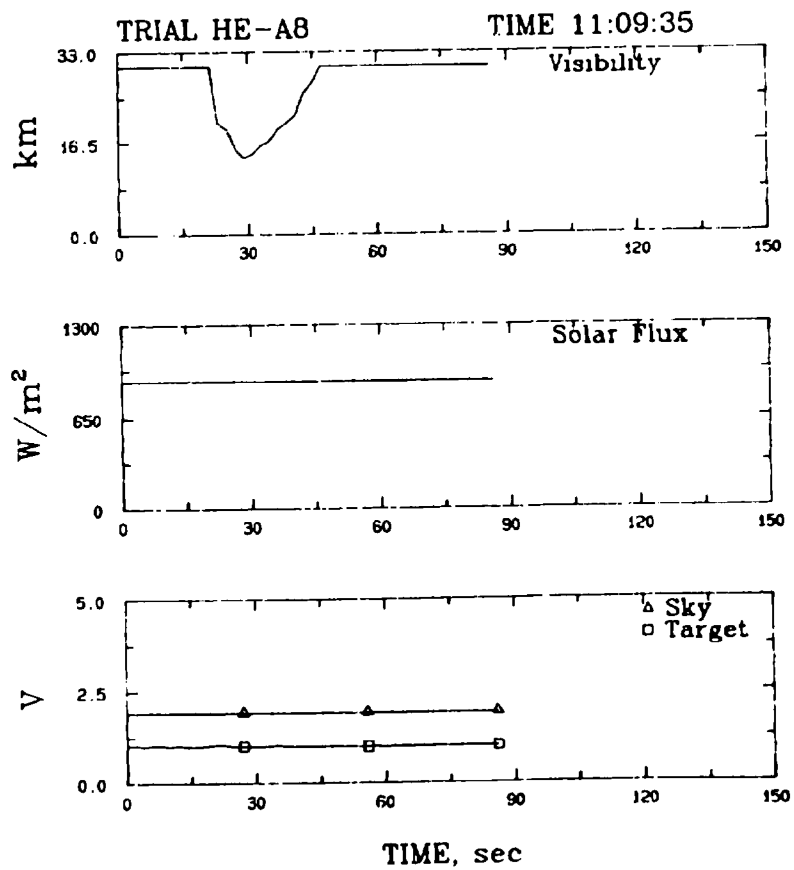
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-A 8
TIME 11:10:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-A 8
TIME 11:10:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.12
0.06
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A8
TIME 11:09:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A8
TIME 11:09:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A8
TIME 11:09:35
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEA9

Date: 25 APRIL 83

Detonation Coordinates (M):
X: 30.7
Y: 20.9

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 7.5 LB
Event Time: 12:41:11

METEOROLOGICAL DATA:

Pasquill Category: A
Richardson Number: -0.901

16 Meter Tower (Means)
Start Time: 12:40:14 End Time: 12:43: 0

	2M	4M	6M	16M
Wind Speed (M/S)	2.61	2.81	2.90	3.65
Wind Dir. (DEG)	155.7	156.7	157.2	159.8
Sigma WSP	0.75	0.82	0.80	1.02
Sigma WDIR	21.2	18.3	16.8	15.1
UVW Components				
U (N-S) (M/S)	2.28	2.50	2.59	3.35
V (E-W) (M/S)	-0.92	-0.96	-1.01	-1.17
W (Vert) (M/S)	0.09	0.27	0.11	*
Sigma U	0.87	0.93	0.87	1.09
Sigma V	0.79	0.75	0.75	0.79
Sigma W	0.21	0.35	0.34	*
Temperature (C)	23.9	22.7	21.8	21.5

Soil Temperature (C): 38.8

Dew Point (C): -9.7

Temperature (C): 21.5

Rel. Hum. (%): 10.4

Abs. Hum. (G/M**3): 1.97

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 1004.6

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.88
Target: 0.97

Sky-Target Contrast: -0.48

CONE INDEX

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	31.0	21.0	38	210	240	250
Post-Shot	31.0	21.0	25	140	192	192

CRATER DATA

Moisture Content: 9.3

CRATER VOLUMES (M**3):
True Crater: 0.429
Apparent Crater: 0.172
Flow: 0.257

DENSITIES (G/CM**3):
Pre-Shot: 1.390
Flow: 1.159
Bottom: 1.120
Side: 1.198

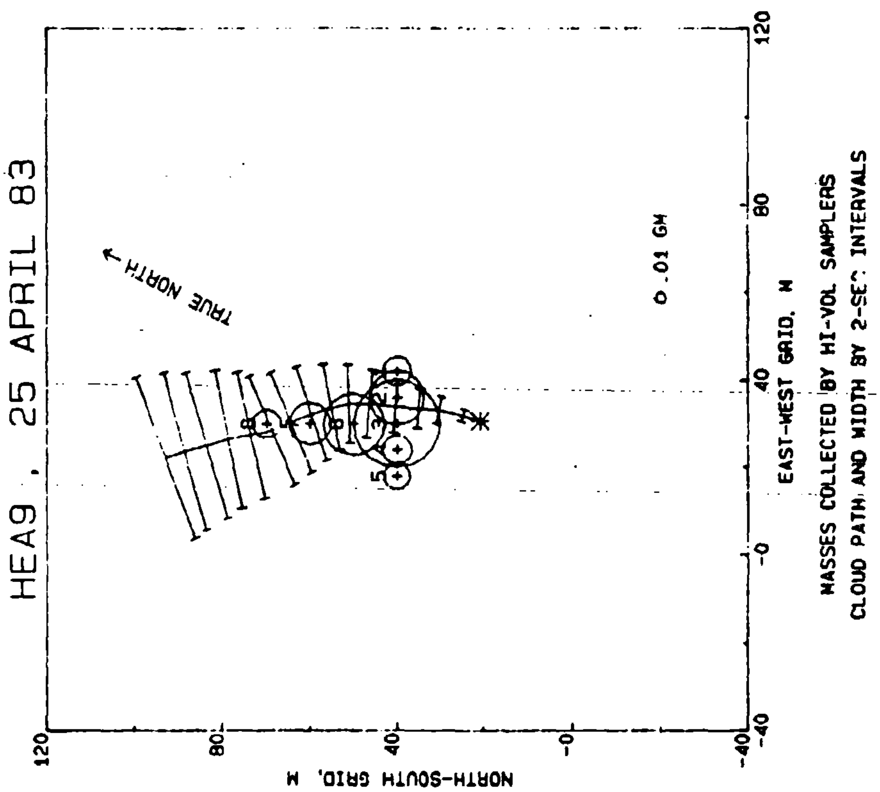
HI VOL DATA (G):

HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0740	0.2598	0.6726	0.0809	0.0605	0.3353	0.1577	0.0724

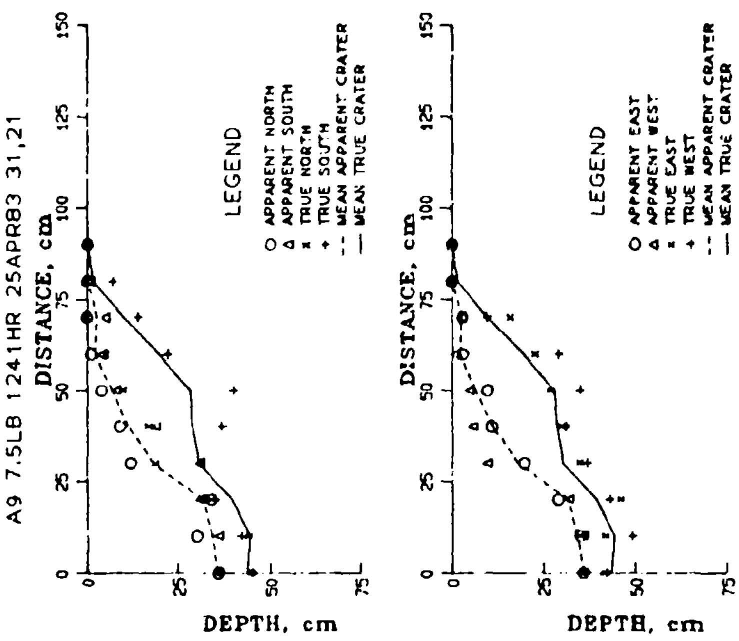
SUM: 1.7132

GELMAN DOSAGE (G S/M**3):

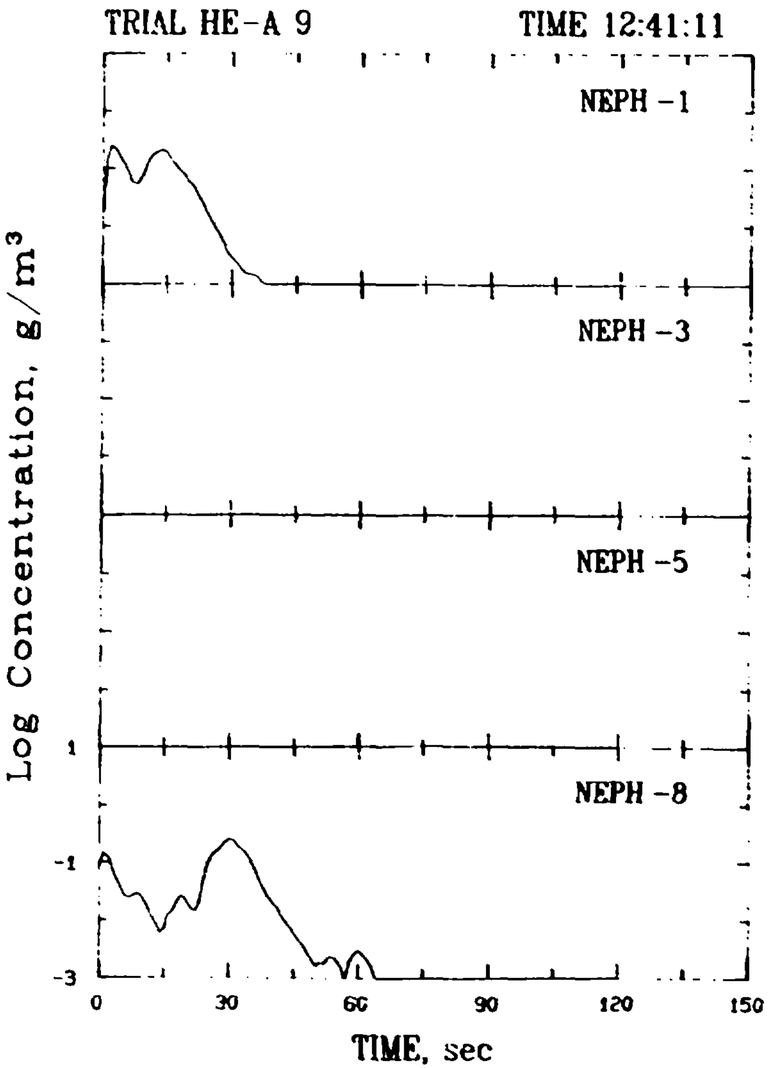
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

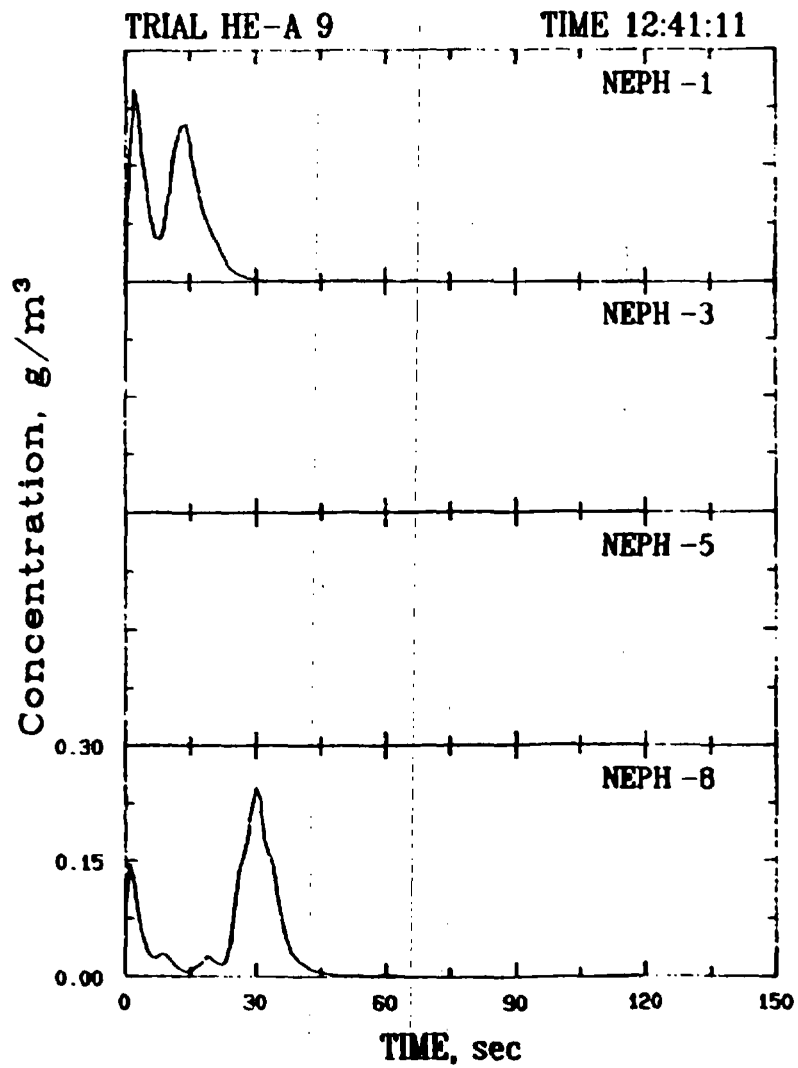


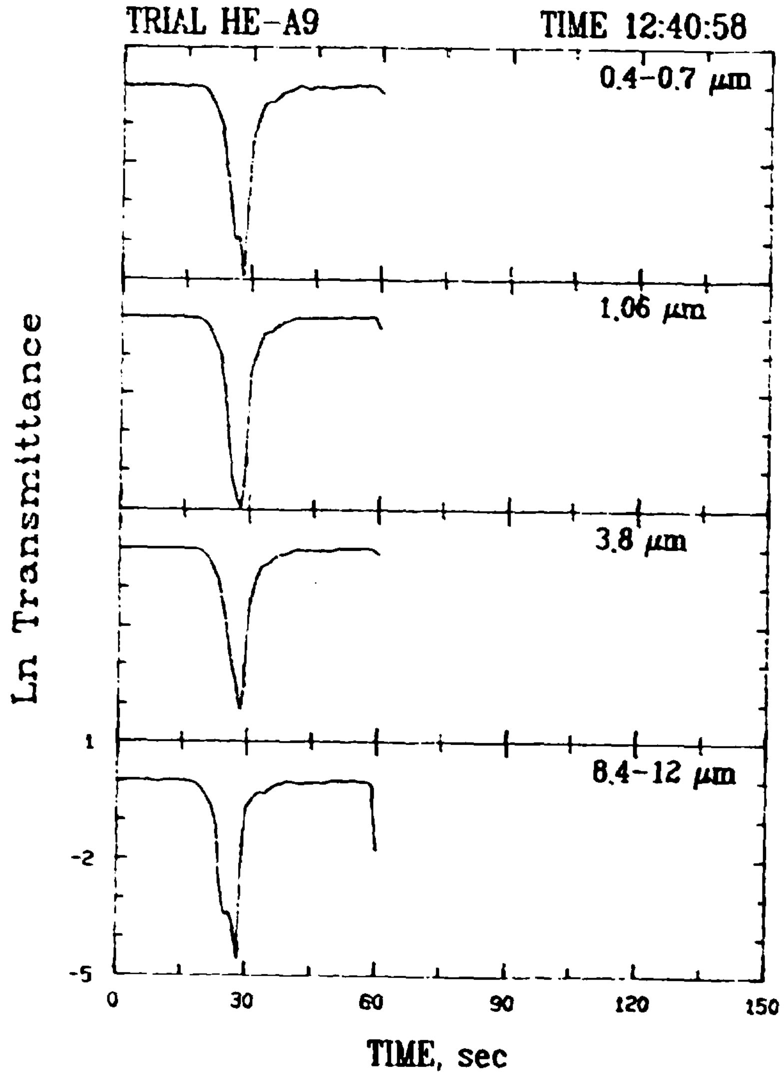
HEA9 , 25 APRIL 83
TRUE NORTH
0 .01 GM
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

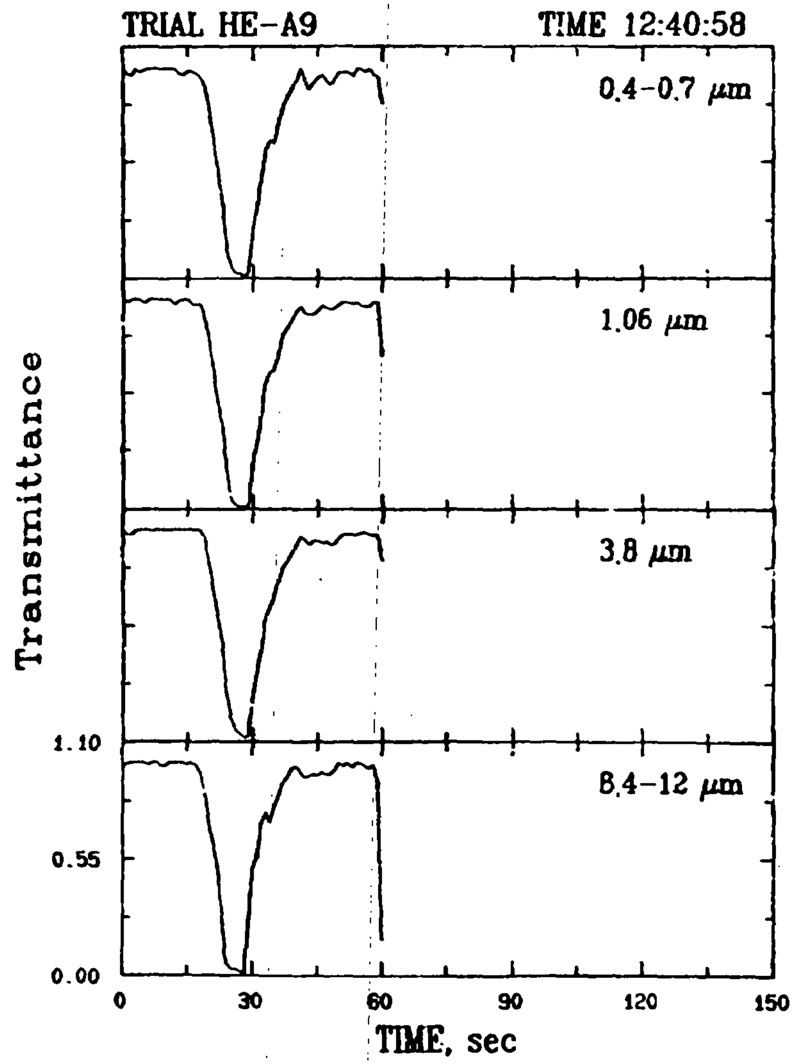


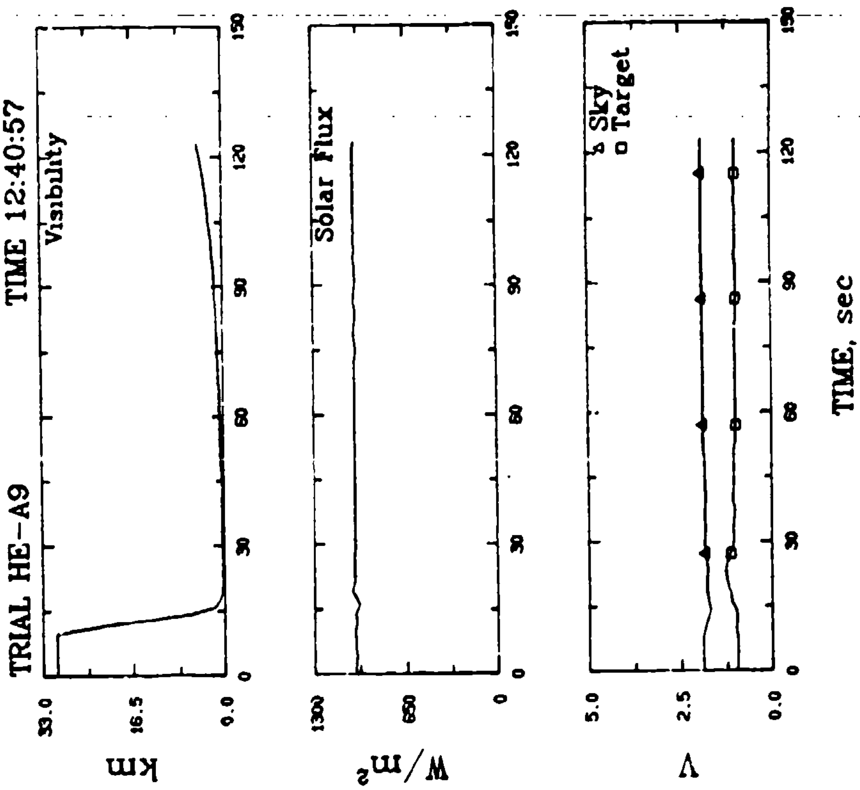
A9 7.5LB 1241HR 25APR83 31,21
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT NORTH
APPARENT SOUTH
TRUE NORTH
TRUE SOUTH
MEAN APPARENT CRATER
MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT EAST
APPARENT WEST
TRUE EAST
TRUE WEST
MEAN APPARENT CRATER
MEAN TRUE CRATER


TRIAL HE-A 9
TIME 12:41:11
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec

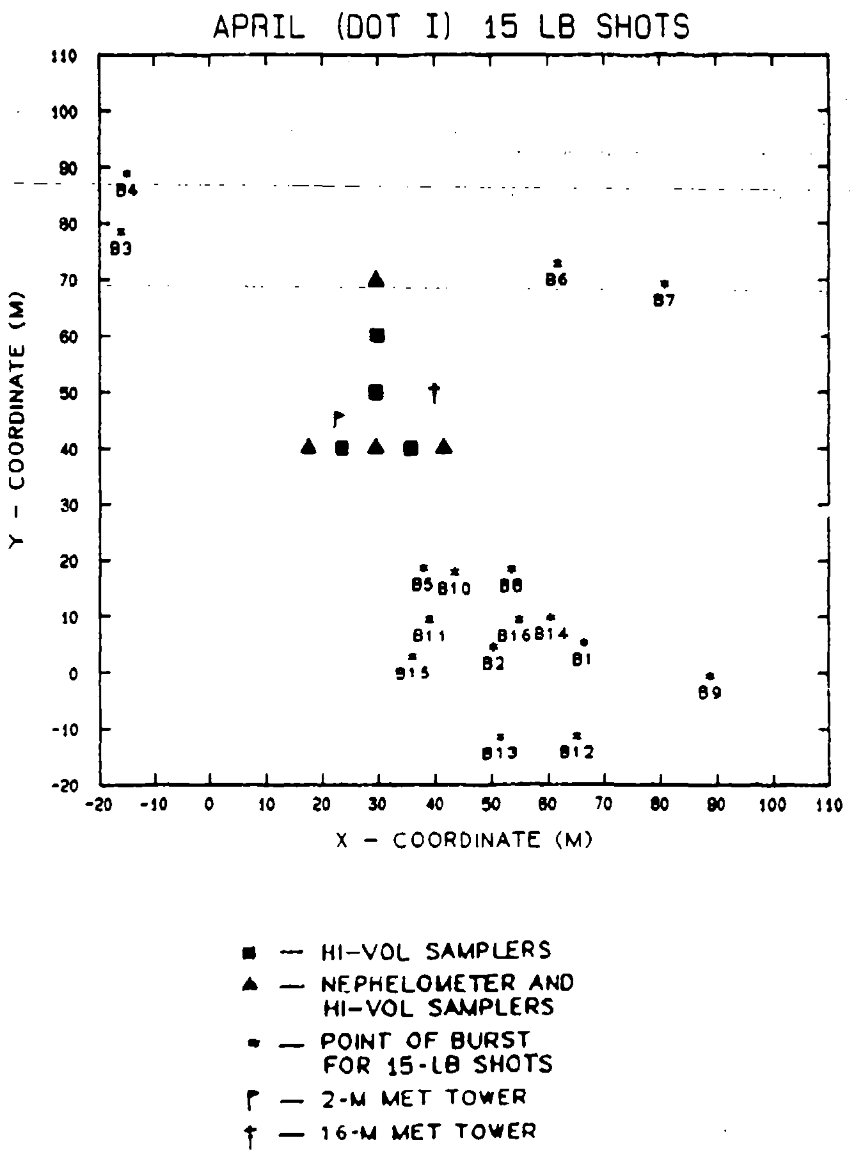

TRIAL HE-A 9
TIME 12:41:11
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.30
0.15
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-A9
TIME 12:40:58
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-A9
TIME 12:40:58
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-A9
TIME 12:40:57
Visibility
Solar Flux
Sky
Target
km
W/m²
V
33.0
16.5
0.0
1300
650
0
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



APRIL (DOT I) 15 LB SHOTS
Y - COORDINATE (M)
X - COORDINATE (M)
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
HI-VOL SAMPLERS
NEPHELOMETER AND HI-VOL SAMPLERS
POINT OF BURST FOR 15-LB SHOTS
2-M MET TOWER
16-M MET TOWER

EVENT SUMMARY DATA

Test Number: HEB1

Surface Tangent

Date: 20 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 66.3
Y: 5.2

Charge Wt: 15.0 LB
Event Time: 11:29:01

METEOROLOGICAL DATA:

Pasquill Category: A
Richardson Number: -1.106

16 Meter Tower (Means)
Start Time: 11:26:58 End Time: 11:31: 9

	2M	4M	6M	16M
Wind Speed (M/S)	3.03	3.12	3.27	3.67
Wind Dir. (DEG)	136.1	132.7	132.7	136.1
Sigma WSP	1.30	1.36	1.45	1.38
Sigma WDIR	24.6	22.1	19.5	16.0
UVW Components				
U (N-S) (M/S)	1.91	1.88	1.99	2.42
V (E-W) (M/S)	-2.07	-2.25	-2.38	-2.56
W (Vert) (M/S)	0.16	0.18	0.11	*
Sigma U	0.91	0.93	0.87	0.78
Sigma V	1.47	1.46	1.55	1.54
Sigma W	0.22	0.27	0.31	*
Temperature (C)	17.9	17.0	16.5	16.1

Soil Temperature (C): 29.0

Solar Flux (W/M**2): 866.1

Dew Point (C): -0.8

Visual Range (M): 30480.0

Temperature (C): 16.3

Vista Ranger Voltages:
Sky: 2.04
Target: 1.22

Rel. Hum. (%): 30.8

Abs. Hum. (G/M**3): 4.30

Sky-Target Contrast: -0.40

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	66.0	5.0	50	200	575	750+
Post-Shot	66.0	5.0	25	92	467	750+

CRATER DATA

Moisture Content: 19.5

CRATER VOLUMES (M**3):
True Crater: 0.750
Apparent Crater: 0.263
Flow: 0.488

DENSITIES (G/CM**3):
Pre-Shot: 1.360
Flow: 0.877
Bottom: 1.007
Side: 0.836

HI VOL DATA (G):

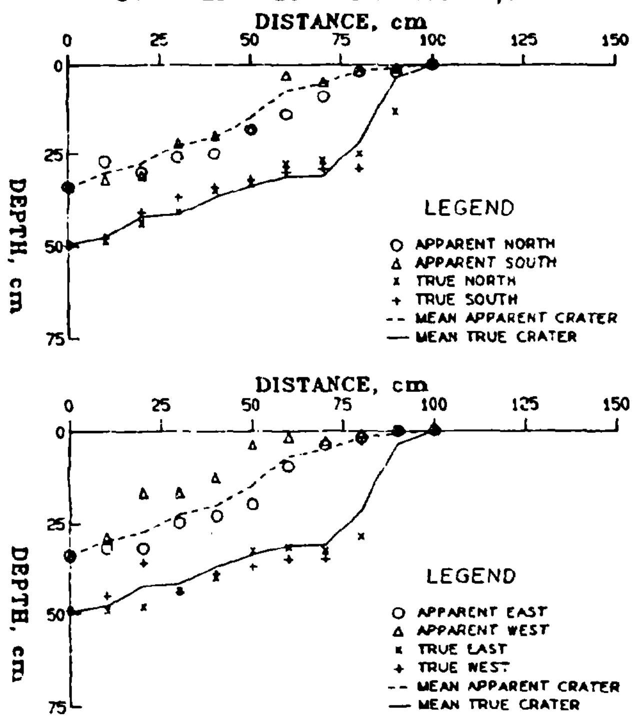
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.3222	0.0914	0.0247	0.0199	0.0170	0.0677	0.0756	0.0620

SUM: 0.6805

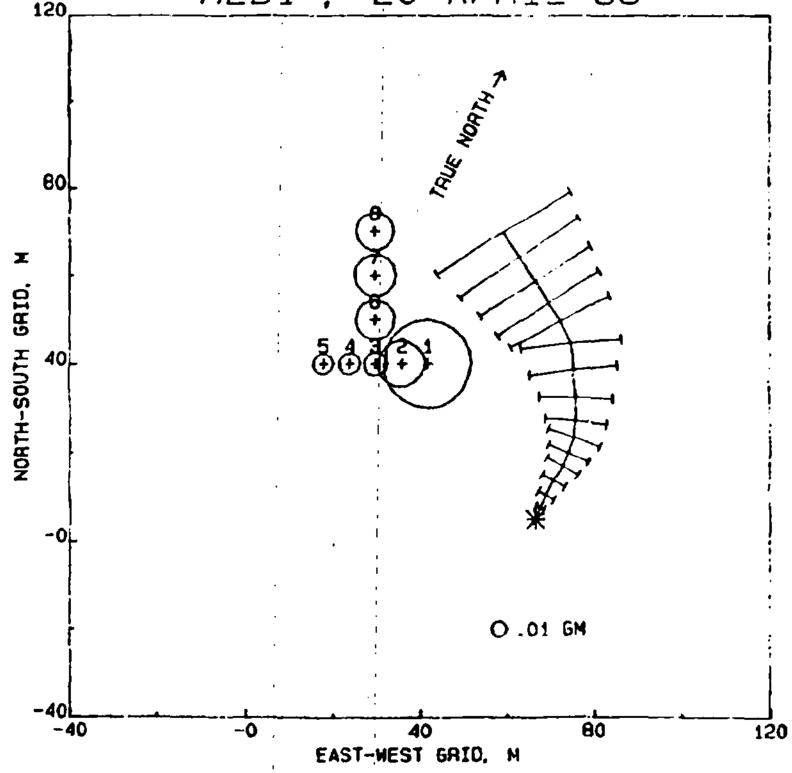
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
154.402	81.600	28.394	21.622

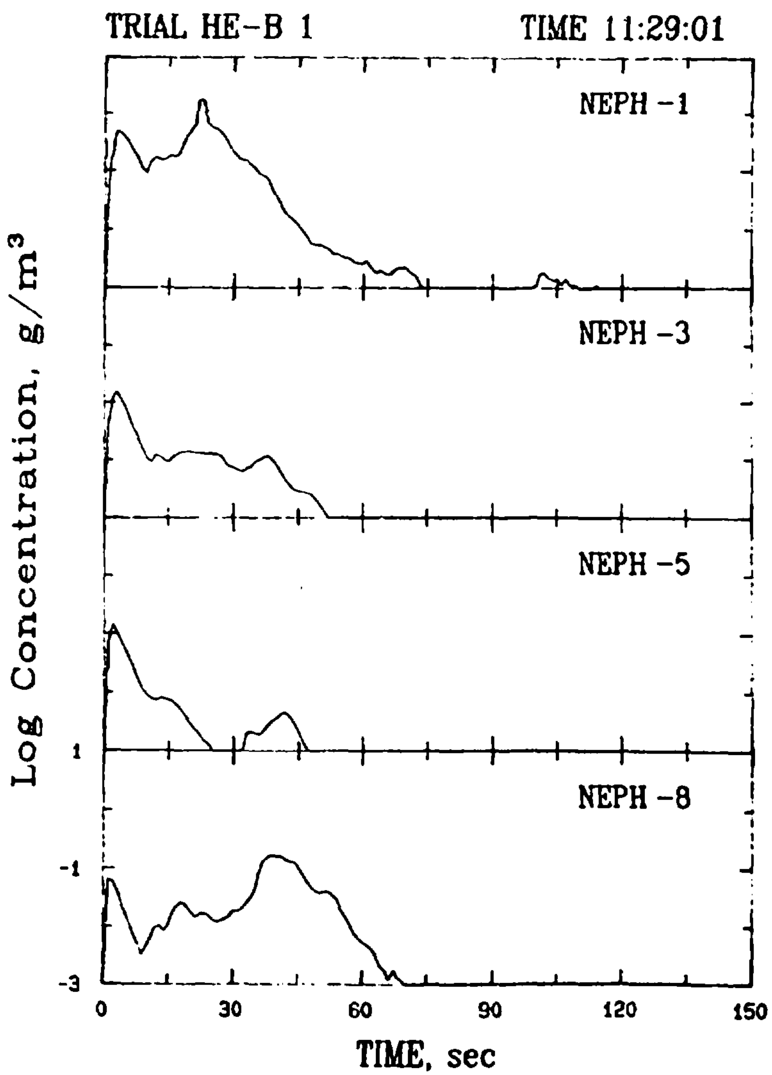
B1 15 LB 1129HR 20APR83 66,5

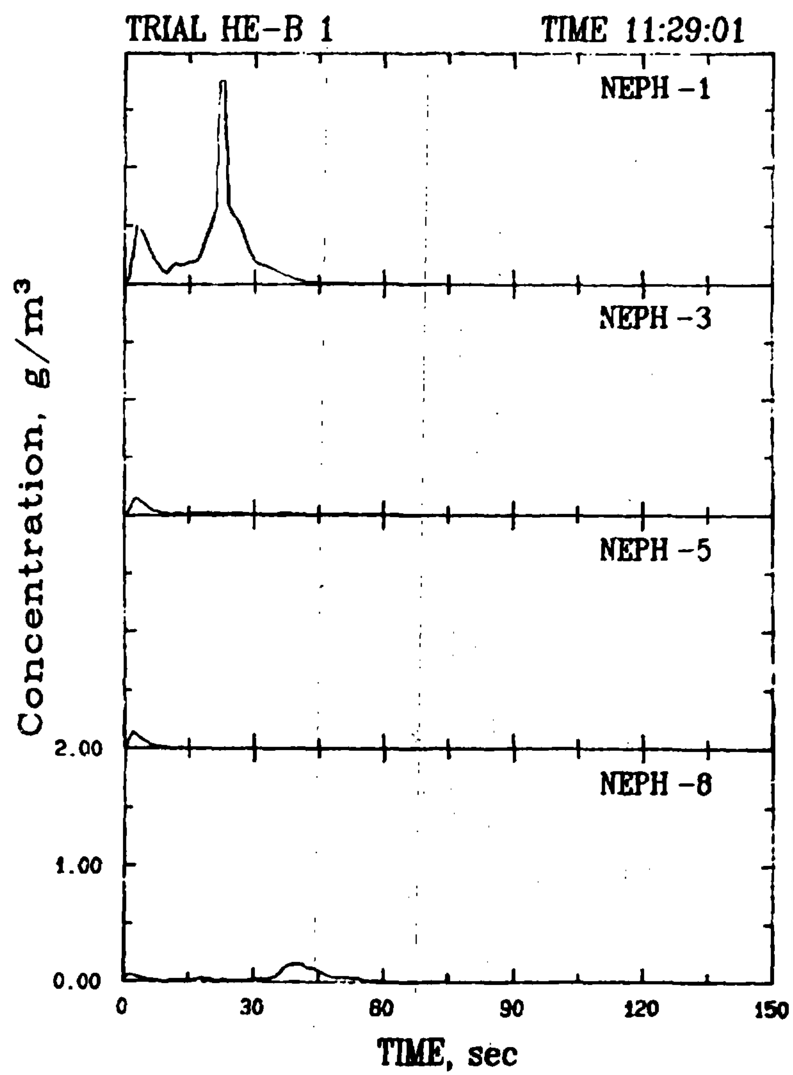


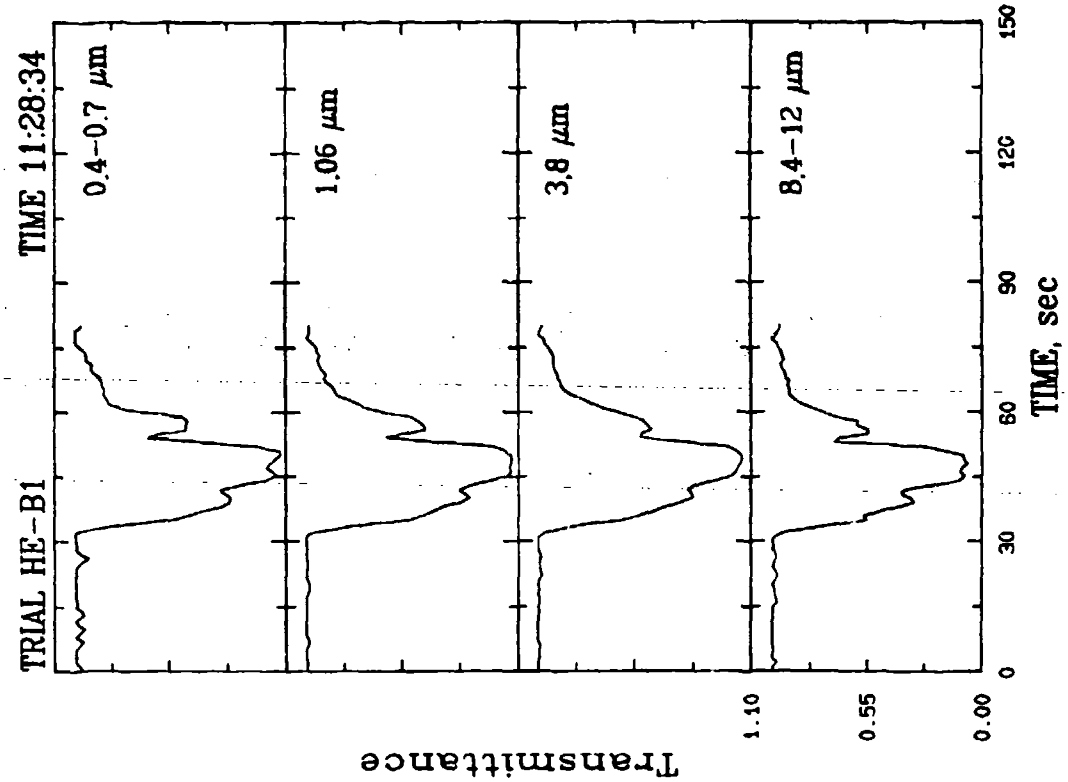
HEB1 , 20 APRIL 83

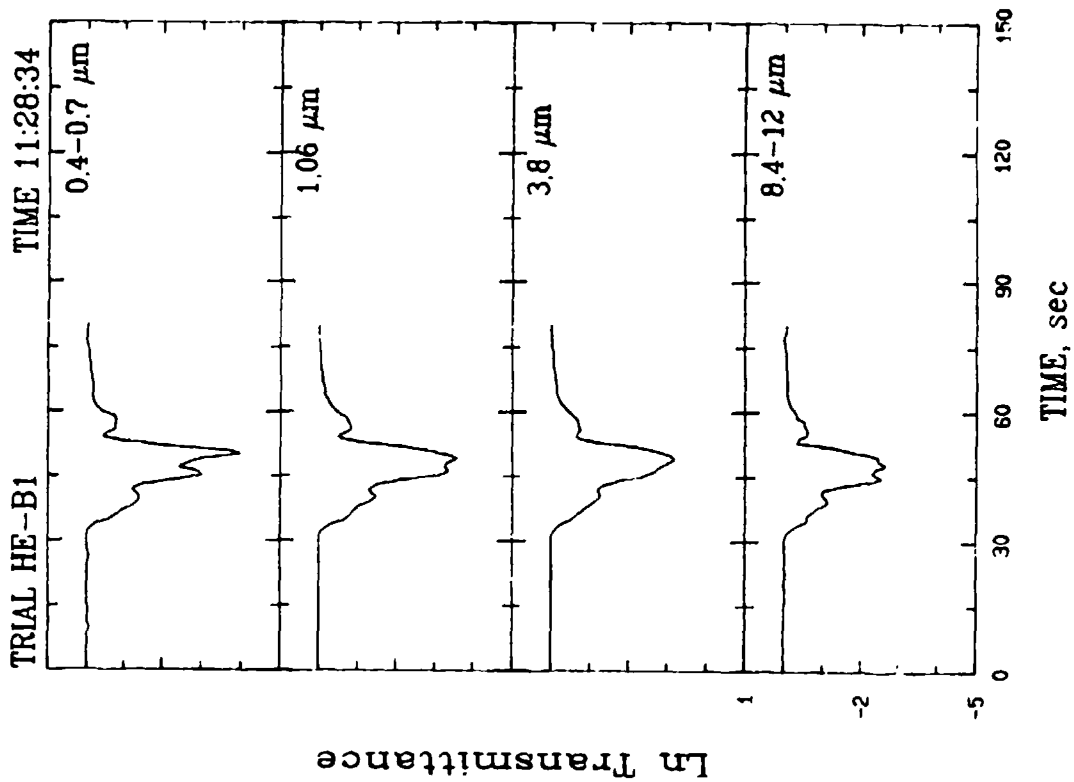


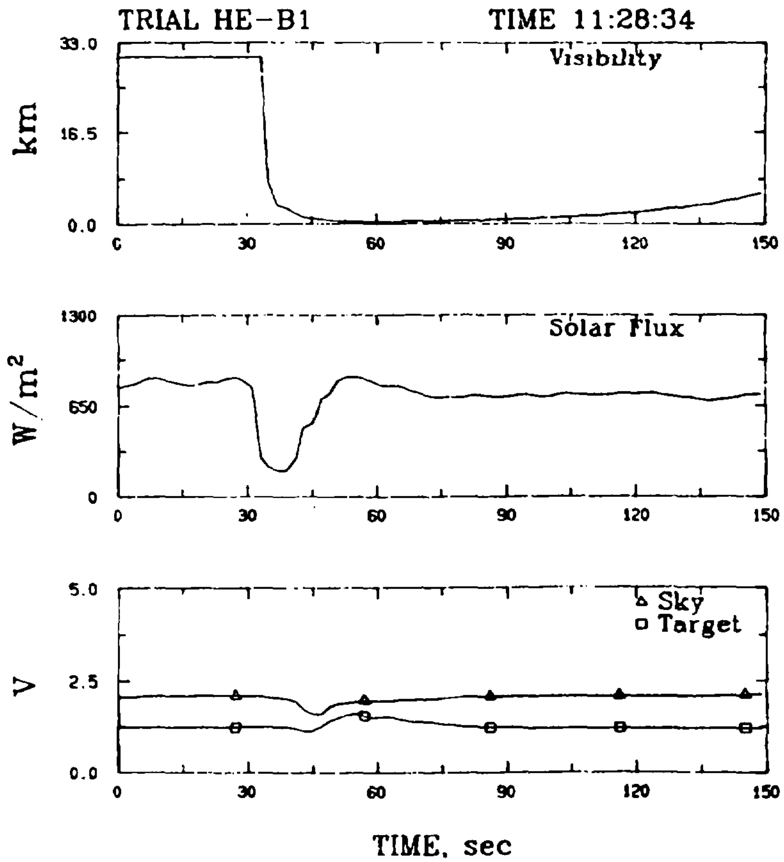
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B 1
TIME 11:29:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m^3
1
-1
-3
0
30
60
90
120
150
TIME, sec

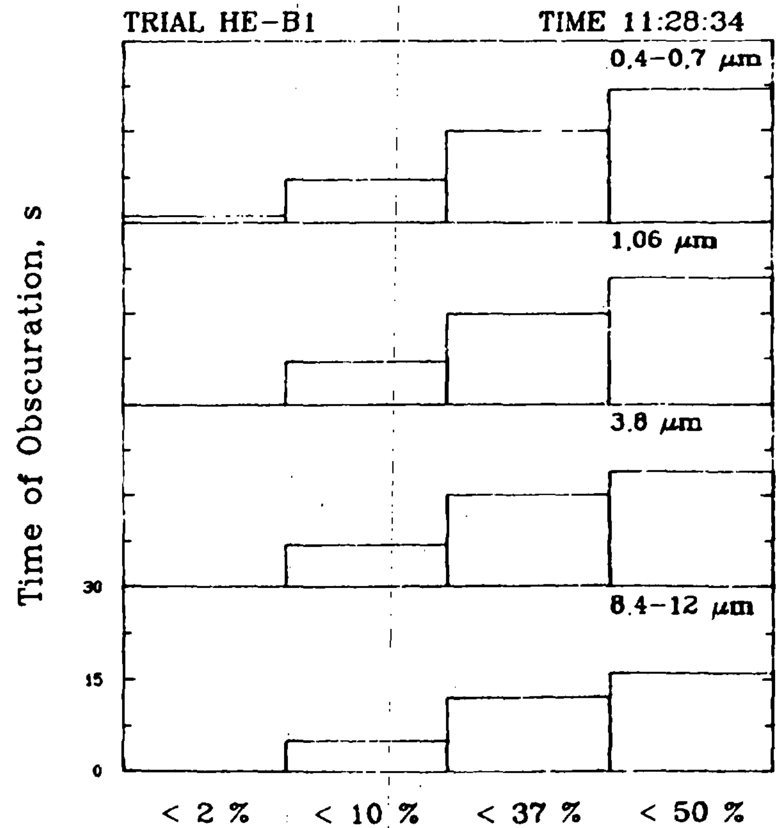

TRIAL HE-B 1
TIME 11:29:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m^3
2.00
1.00
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B1
TIME 11:28:34
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B1
TIME 11:28:34
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B1
TIME 11:28:34
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-B1
TIME 11:28:34
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB2

Date: 20 APRIL 83
Detonation Coordinates (M):
X: 50.4
Y: 4.5

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 12:49:02

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.724

16 Meter Tower (Means)
Start Time: 12:46: 5 End Time: 12:51: 3

	2M	4M	6M	16M
Wind Speed (M/S)	2.98	3.08	3.18	3.58
Wind Dir. (DEG)	129.3	132.1	131.6	132.4
Sigma WSP	1.11	1.29	1.43	1.63
Sigma WDIR	18.3	17.3	19.2	18.8
UVW Components				
U (N-S) (M/S)	1.82	1.99	2.10	2.42
V (E-W) (M/S)	-2.15	-2.13	-2.17	-2.40
W (Vert) (M/S)	0.09	0.08	-0.03	*
Sigma U	1.05	1.14	1.19	1.43
Sigma V	1.05	1.15	1.26	1.37
Sigma W	0.18	0.32	0.37	*
Temperature (C)	19.6	18.6	18.1	17.8

Soil Temperature (C): 32.2

Dew Point (C): -1.5

Temperature (C): 17.7

Rel. Hum. (%): 26.6

Abs. Hum. (G/M**3): 4.03

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 831.5

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 2.38
Target: 1.31

Sky-Target Contrast: -0.45

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	46.0	5.0	45	178	163	512
Post-Shot	46.0	5.0	50	133	167	233

CRATER DATA

Moisture Content: 22.0

CRATER VOLUMES (M**3):
True Crater: 0.848
Apparent Crater: 0.224
Flow: 0.123

DENSITIES (G/CM**3):
Pre-Shot: 1.520
Flow: 0.950
Bottom: *
Side: *

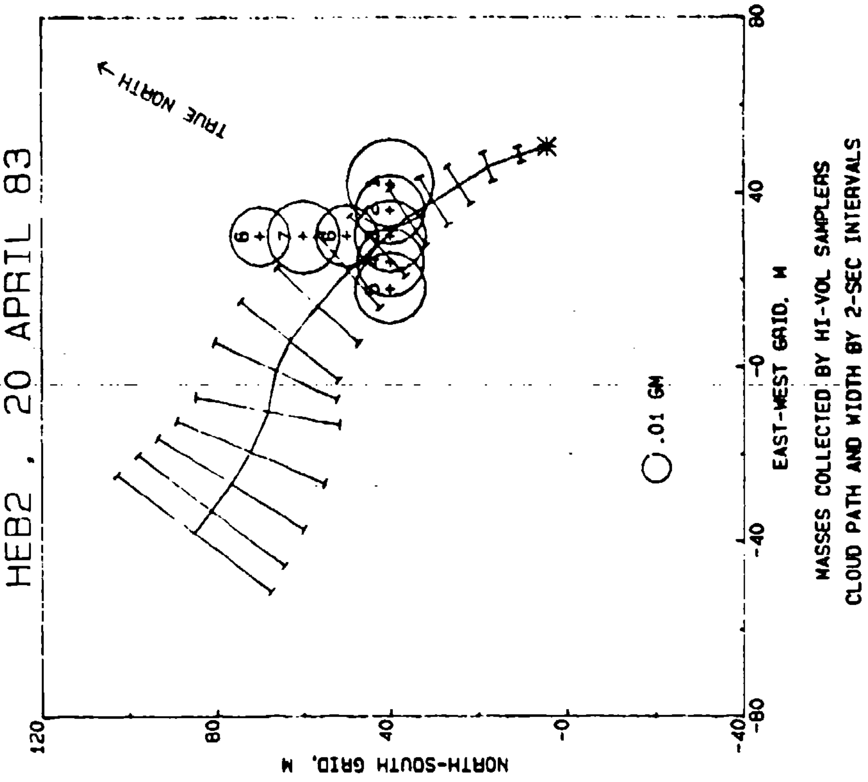
HI VOL DATA (G):

HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0904	0.0570	0.0617	0.0536	0.0598	0.0456	0.0621	0.0430

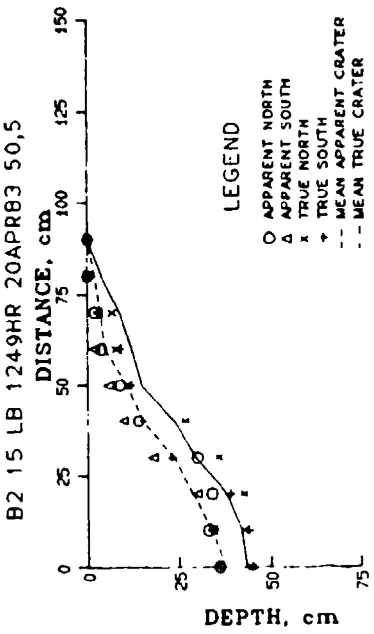
SUM: 0.4732

GELMAN DOSAGE (G S/M**3):

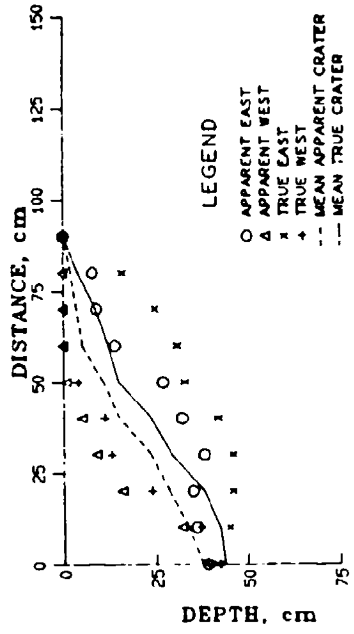
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	8.000	3.736	2.703



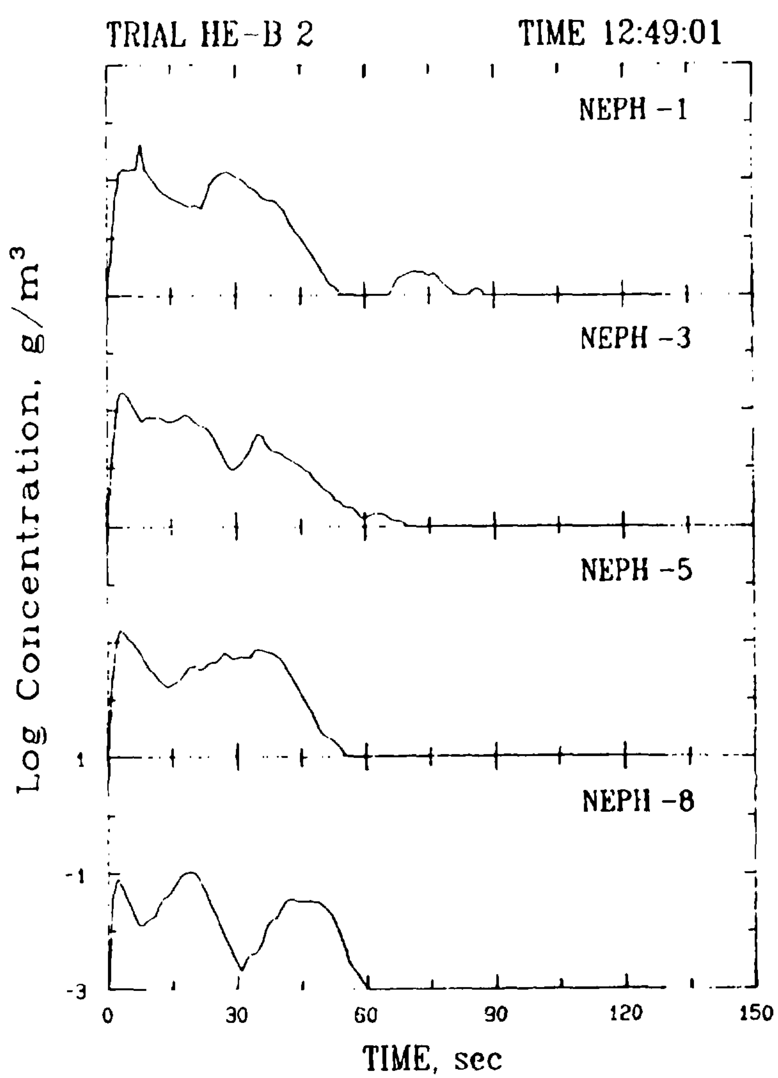
HEB2 , 20 APRIL 83
TRUE NORTH
.01 GM
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS



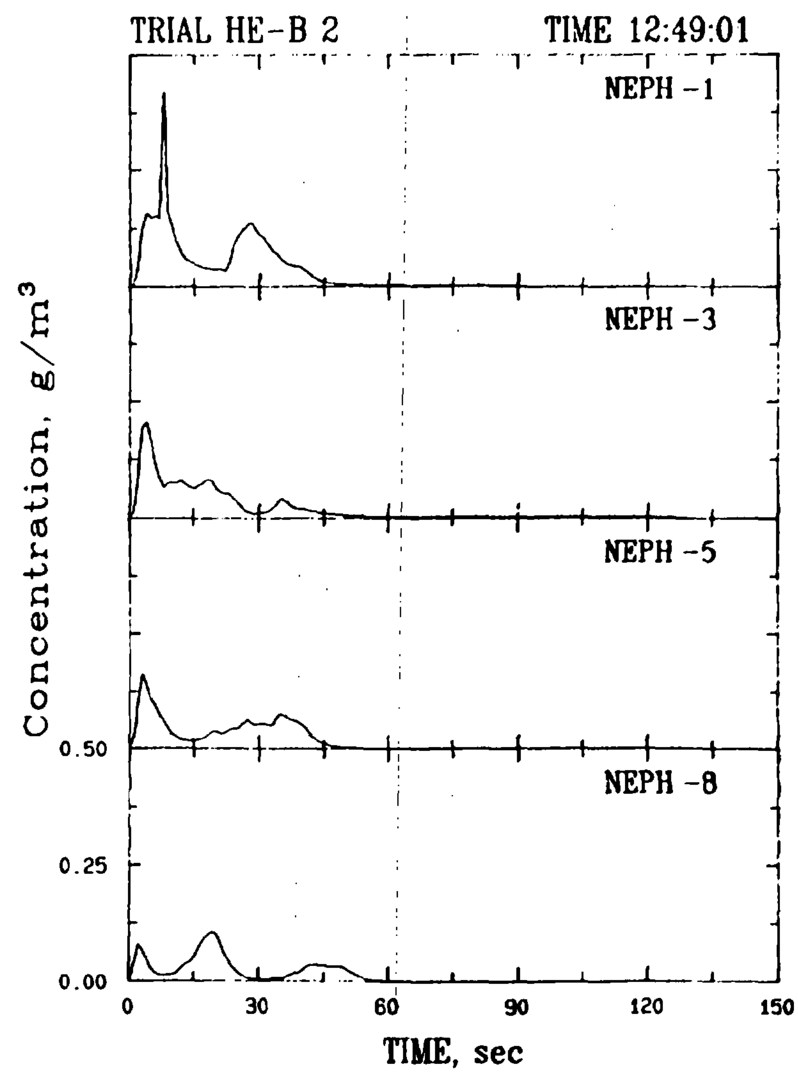
B2 15 LB 1249HR 20APR83 50,5
DISTANCE, cm
DEPTH, cm
LEGEND
O APPARENT NORTH
Δ APPARENT SOUTH
x TRUE NORTH
+ TRUE SOUTH
-- MEAN APPARENT CRATER
-·- MEAN TRUE CRATER



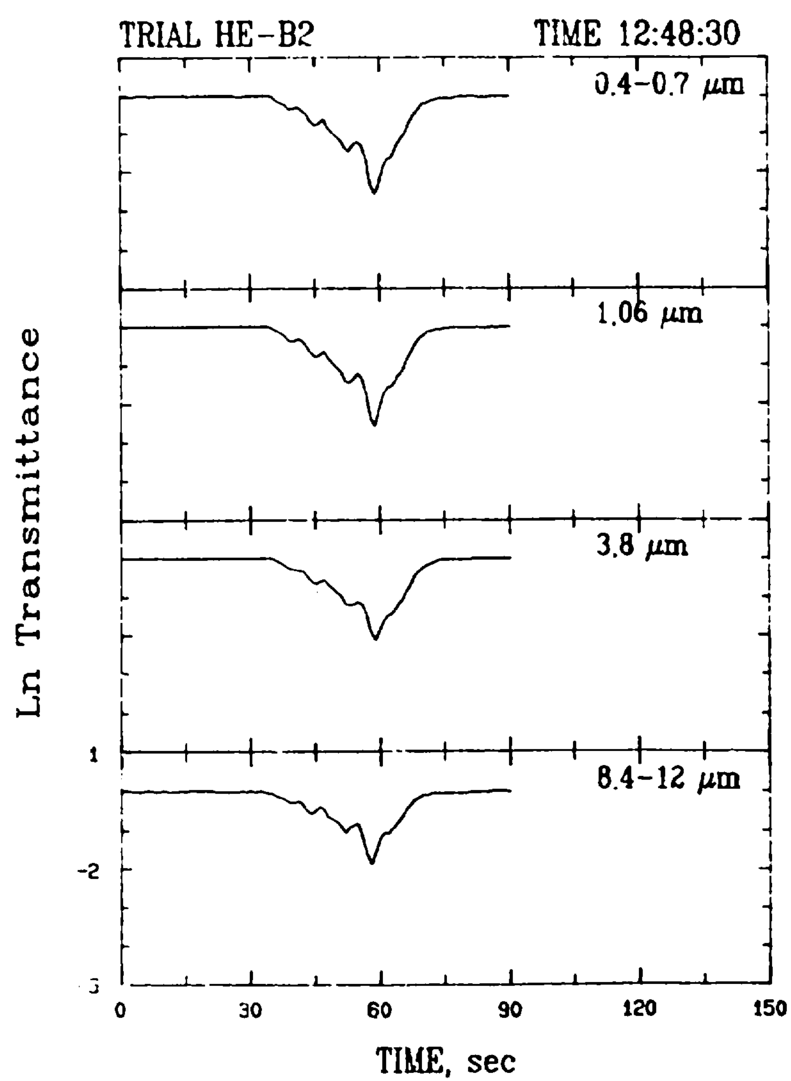
DISTANCE, cm
DEPTH, cm
LEGEND
O APPARENT EAST
Δ APPARENT WEST
x TRUE EAST
+ TRUE WEST
-- MEAN APPARENT CRATER
-·- MEAN TRUE CRATER

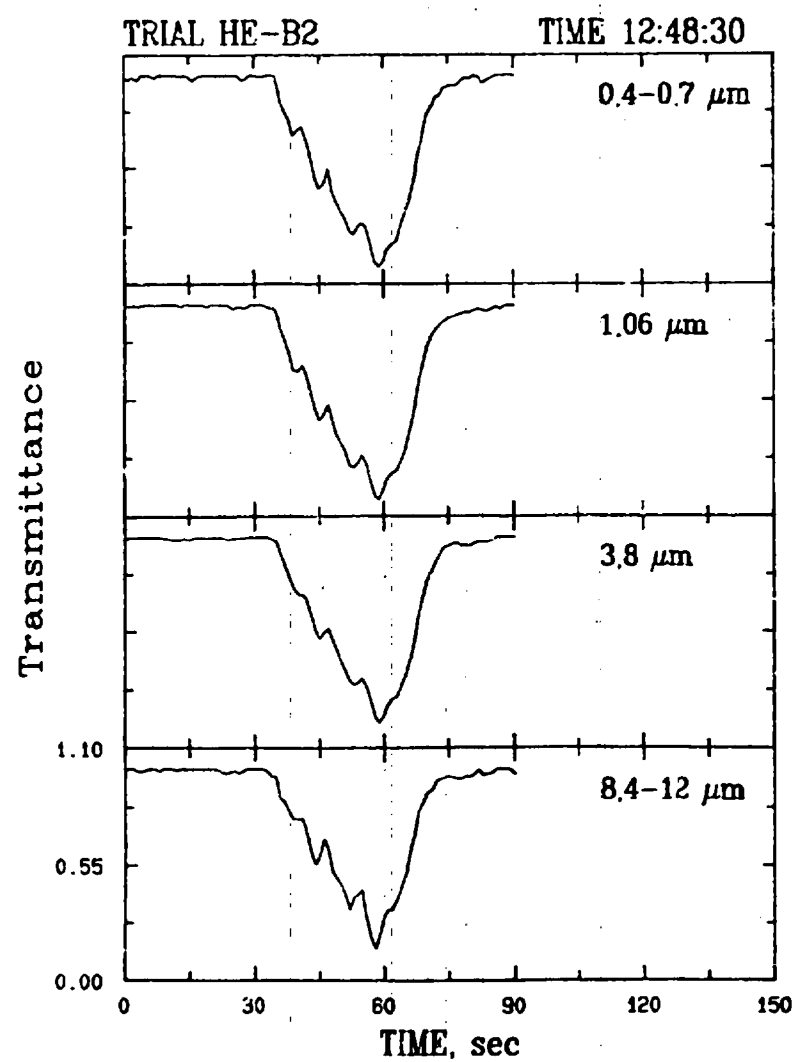


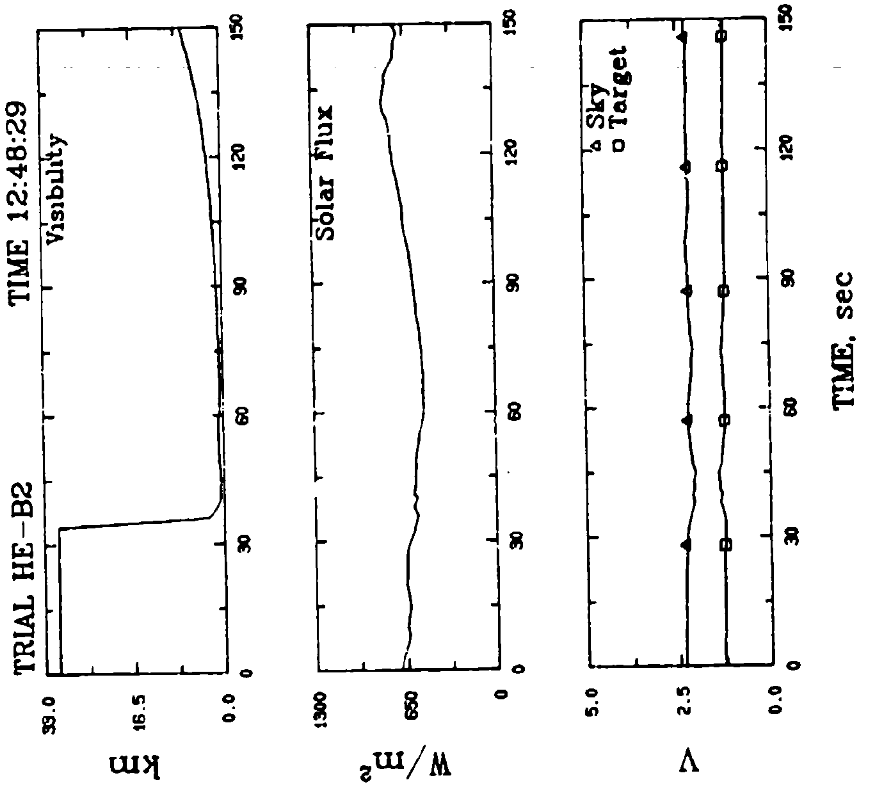
TRIAL HE-B 2
TIME 12:49:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec



TRIAL HE-B 2
TIME 12:49:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.50
0.25
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B2
TIME 12:48:30
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B2
TIME 12:48:30
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B2
TIME 12:48:29
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB3

Surface Tangent

Date: 21 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: -16.0
Y: 78.4

Charge Wt: 15.0 LB
Event Time: 11:06:35

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.195

16 Meter Tower (Means)
Start Time: 10:58: 4 End Time: 11: 8:21

	2M	4M	6M	16M
Wind Speed (M/S)	6.66	7.50	7.93	8.45
Wind Dir. (DEG)	267.0	265.4	265.3	263.0
Sigma WSP	1.70	1.78	1.75	1.75
Sigma WDIR	17.3	17.1	16.1	16.1
UVW Components				
U (N-S) (M/S)	0.17	0.40	0.46	0.83
V (E-W) (M/S)	6.34	7.14	7.60	8.06
W (Vert) (M/S)	0.14	0.40	0.33	*
Sigma U	2.08	2.29	2.27	2.42
Sigma V	1.63	1.73	1.70	1.71
Sigma W	0.29	0.41	0.48	*
Temperature (C)	19.6	18.8	18.5	17.8

Soil Temperature (C): 31.0

Solar Flux (W/M**2): 972.3

Dew Point (C): -4.8

Visual Range (M): 30480.0

Temperature (C): 18.3

Vista Ranger Voltages:
Sky: 3.08
Target: 1.00

Rel. Hum. (%): 19.5

Abs. Hum. (G/M**3): 3.06

Sky-Target Contrast: -0.67

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	-10.0	78.0	25	92	296	525
Post-Shot	-10.0	78.0	50	230	208	167

CRATER DATA

Moisture Content: 13.3

CRATER VOLUMES (M**3):
True Crater: 0.738
Apparent Crater: 0.215
Flow: 0.523

DENSITIES (G/CM**3):
Pre-Shot: 1.360
Flow: 0.934
Bottom: 0.984
Side: 0.884

HI VOL DATA (G):

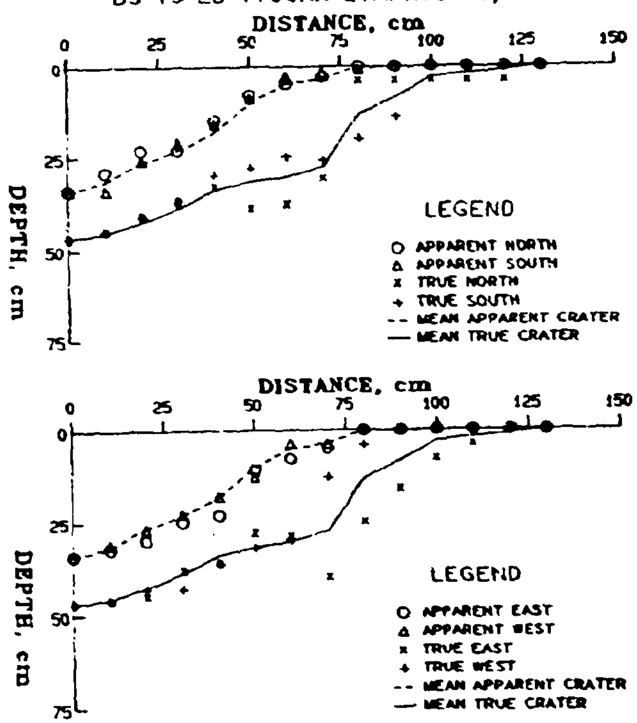
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0165	0.0213	0.0297	0.0246	0.2910	0.0206	0.0148	0.0056

SUM: 0.4241

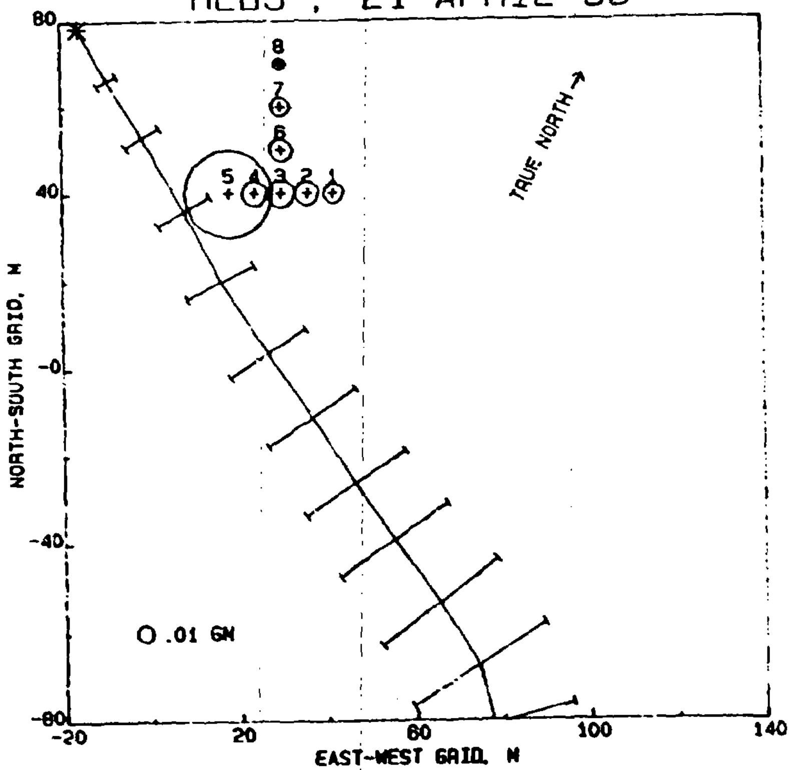
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
7.583	5.600	1.494	1.622

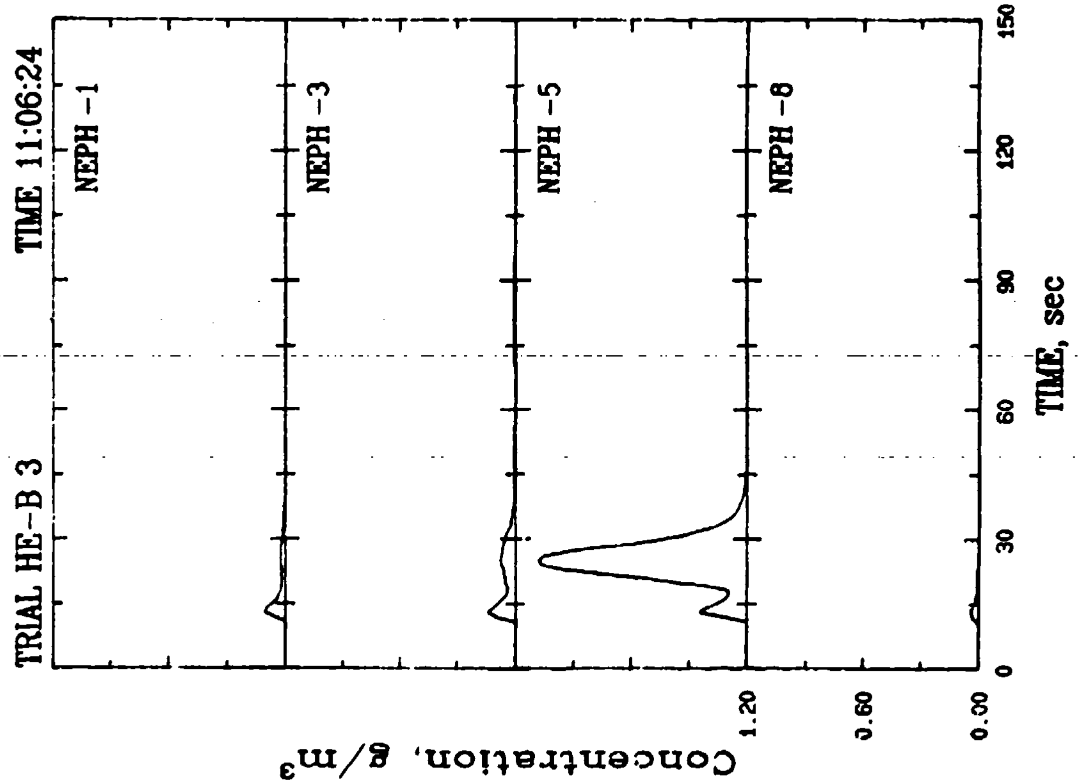
B3 15 LB 1106HR 21APR83 16,78



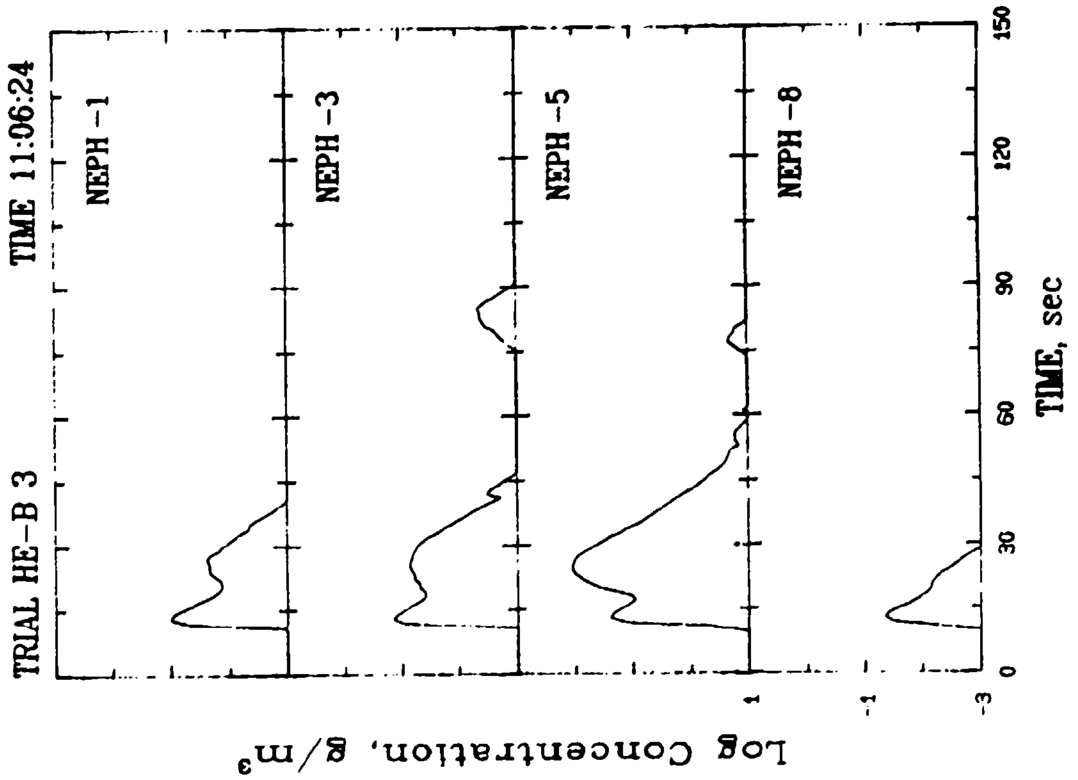
HEB3 . 21 APRIL 83



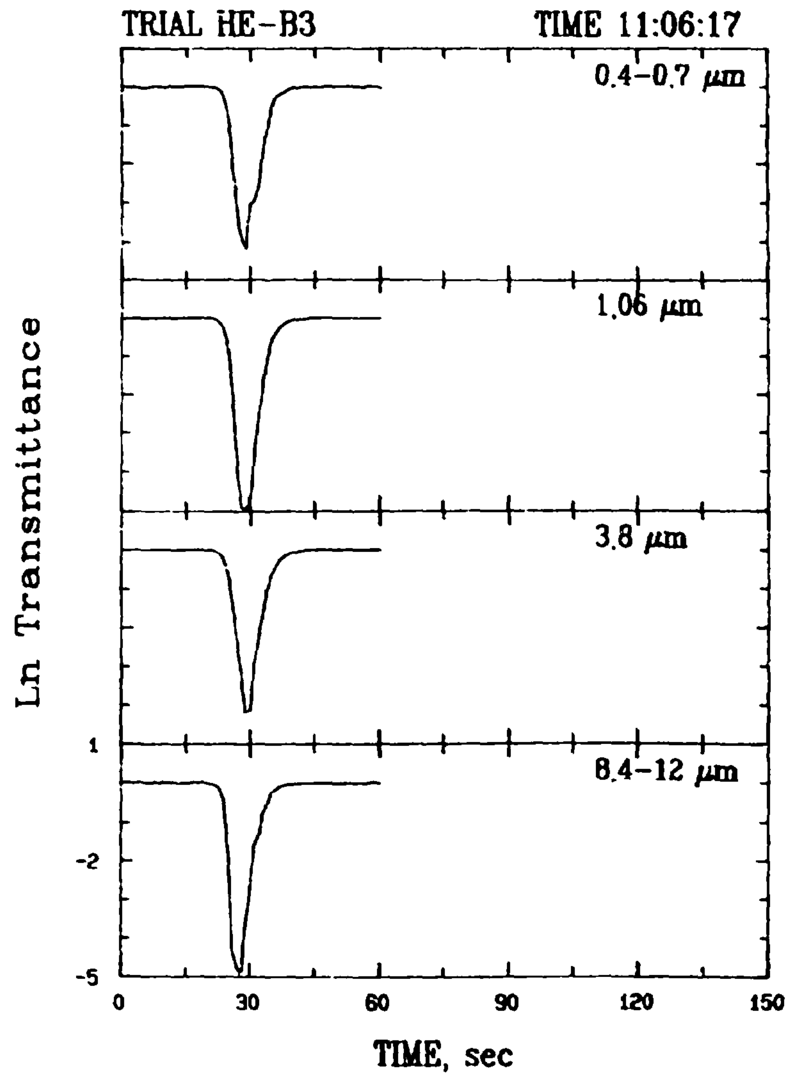
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS



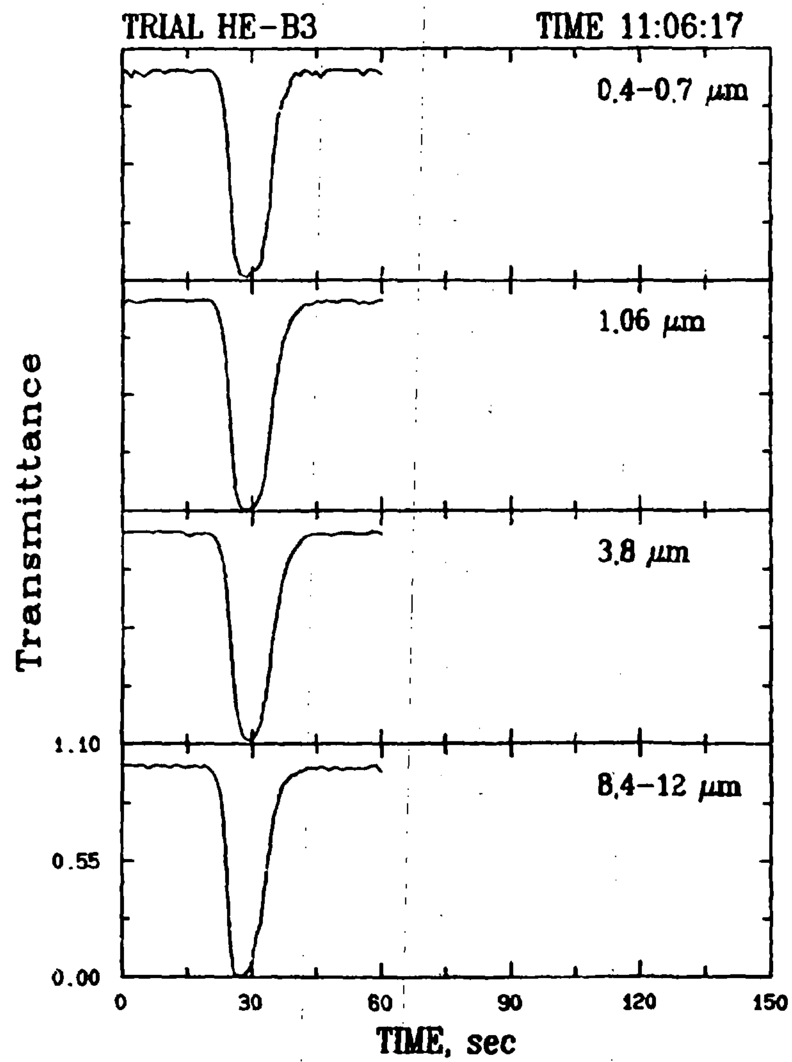
TRIAL HE-B 3
TIME 11:06:24
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
1.20
0.60
0.00
0
30
60
90
120
150
TIME, sec



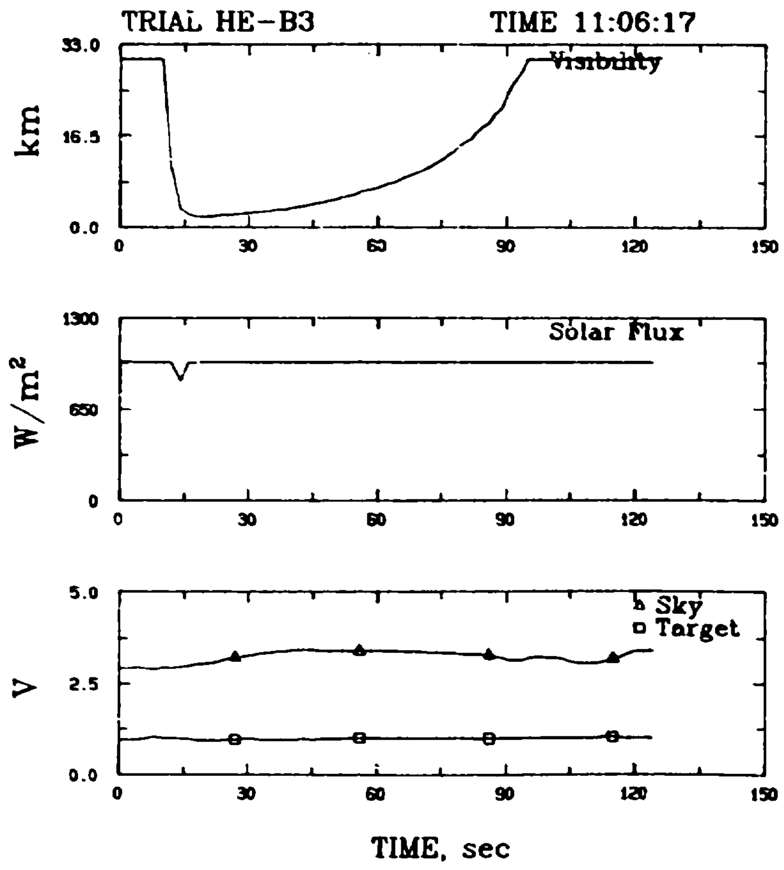
TRIAL HE-B 3
TIME 11:06:24
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



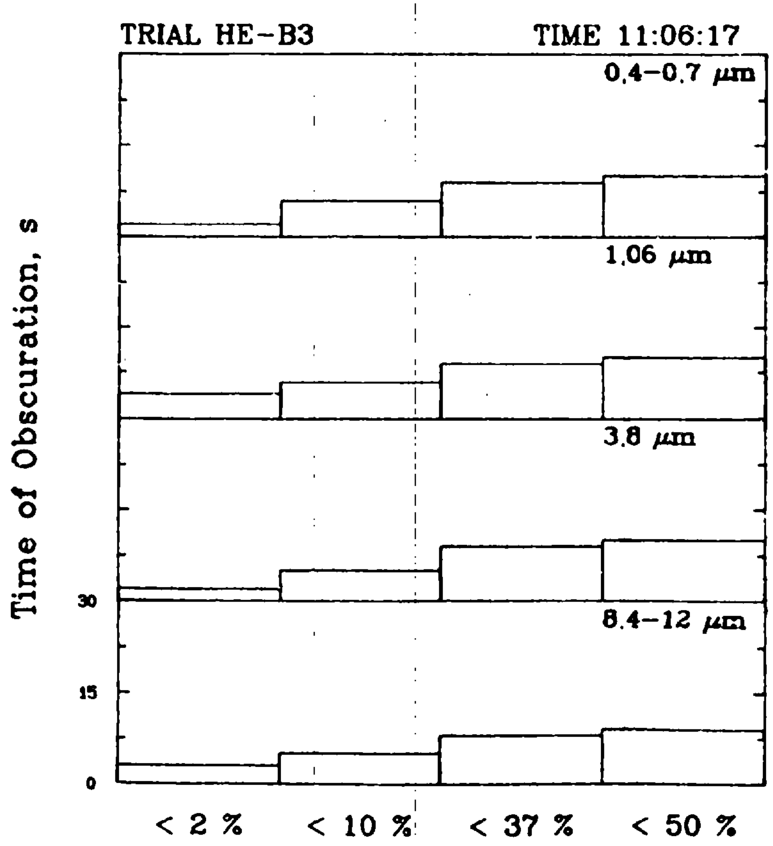
TRIAL HE-B3
TIME 11:06:17
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B3
TIME 11:06:17
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B3
TIME 11:06:17
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-B3
TIME 11:06:17
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB4

Surface Tangent

Date: 21 APRIL 83
Detonation Coordinates (M):
X: -14.9
Y: 88.8

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 12:22:44

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.164

16 Meter Tower (Means)
Start Time: 12:19:46 End Time: 12:24:44

	2M	4M	6M	16M
Wind Speed (M/S)	5.76	7.47	7.86	8.42
Wind Dir. (DEG)	282.7	282.0	281.3	281.1
Sigma WSP	1.93	2.16	2.14	2.24
Sigma WDIR	11.4	12.2	11.9	15.5
UVW Components				
U (N-S) (M/S)	-1.47	-1.52	-1.51	-1.53
V (E-W) (M/S)	6.47	7.17	7.57	8.04
W (Vert) (M/S)	0.12	0.18	0.26	*
Sigma U	1.27	1.38	1.42	1.81
Sigma V	1.93	2.20	2.18	2.39
Sigma W	0.29	0.41	0.46	*
Temperature (C)	20.7	20.2	19.8	18.9

Soil Temperature (C): 35.9

Solar Flux (W/M**2): 1013.5

Dew Point (C): -7.1

Visual Range (M): 30480.0

Temperature (C): 19.1

Vista Ranger Voltages:
Sky: 3.81
Target: 0.93

Rel. Hum. (%): 25.2

Abs. Hum. (G/M**3): 2.50

Sky-Target Contrast: -0.76

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	-15.0	89.0	*	*	*	*
Post-Shot	-15.0	89.0	*	*	*	*

CRATER DATA

Moisture Content: *

CRATER VOLUMES (M**3):
True Crater: *
Apparent Crater: *
Flow: *

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: *
Bottom: *
Side: *

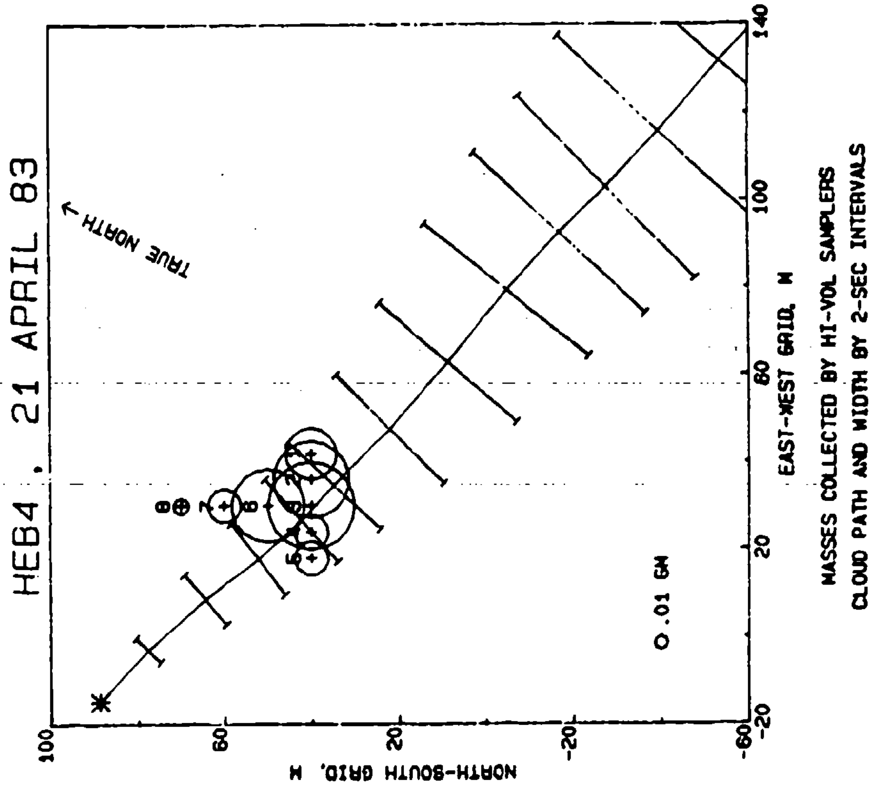
HI VOL DATA (G):

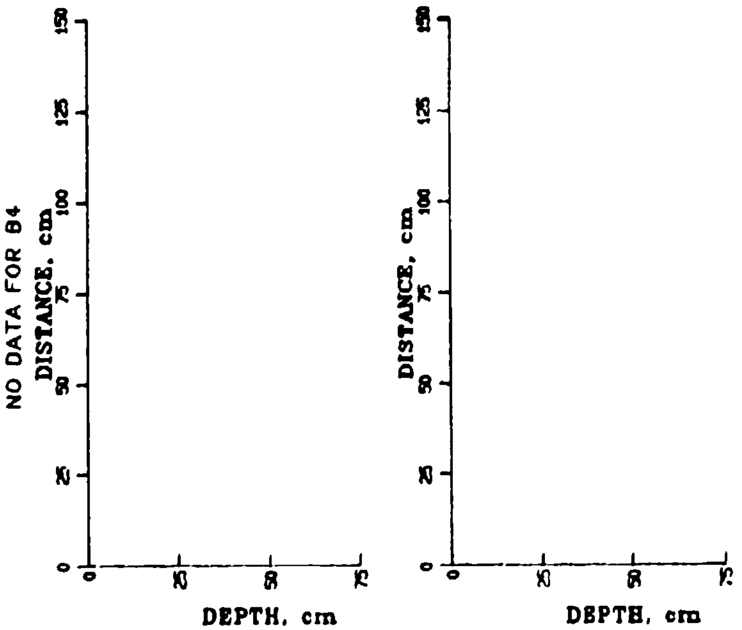
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.1405	0.3135	0.4069	0.0627	0.0624	0.2859	0.0594	0.0121

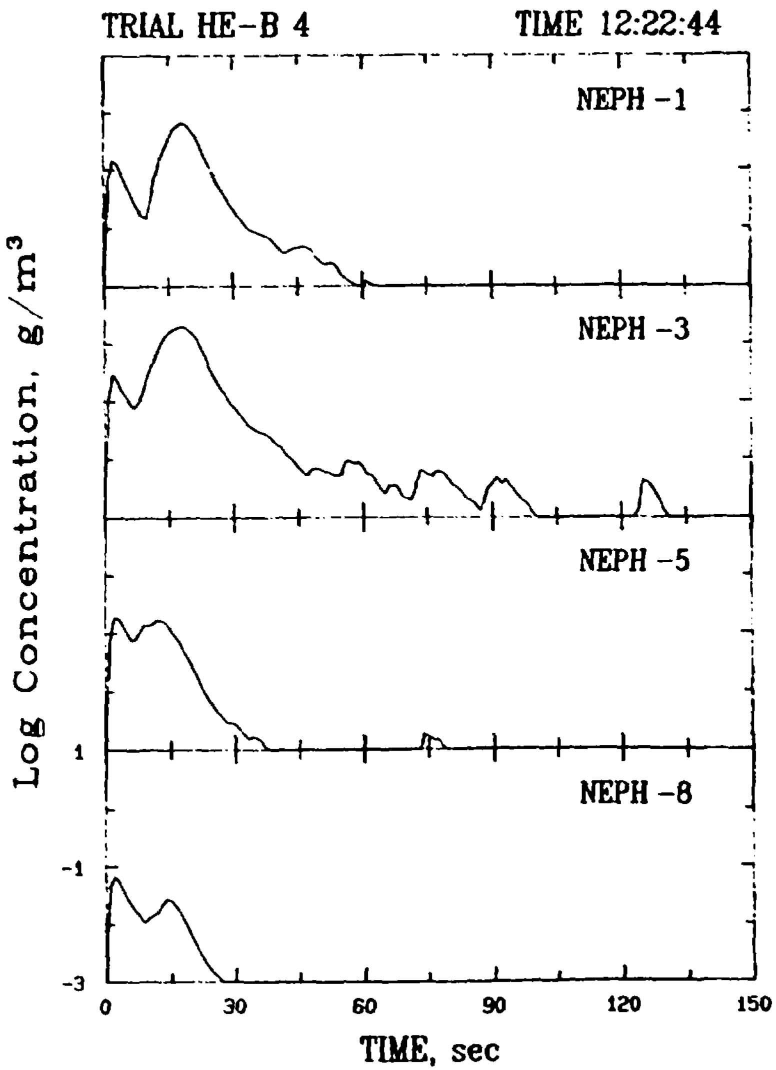
SUM: 1.3434

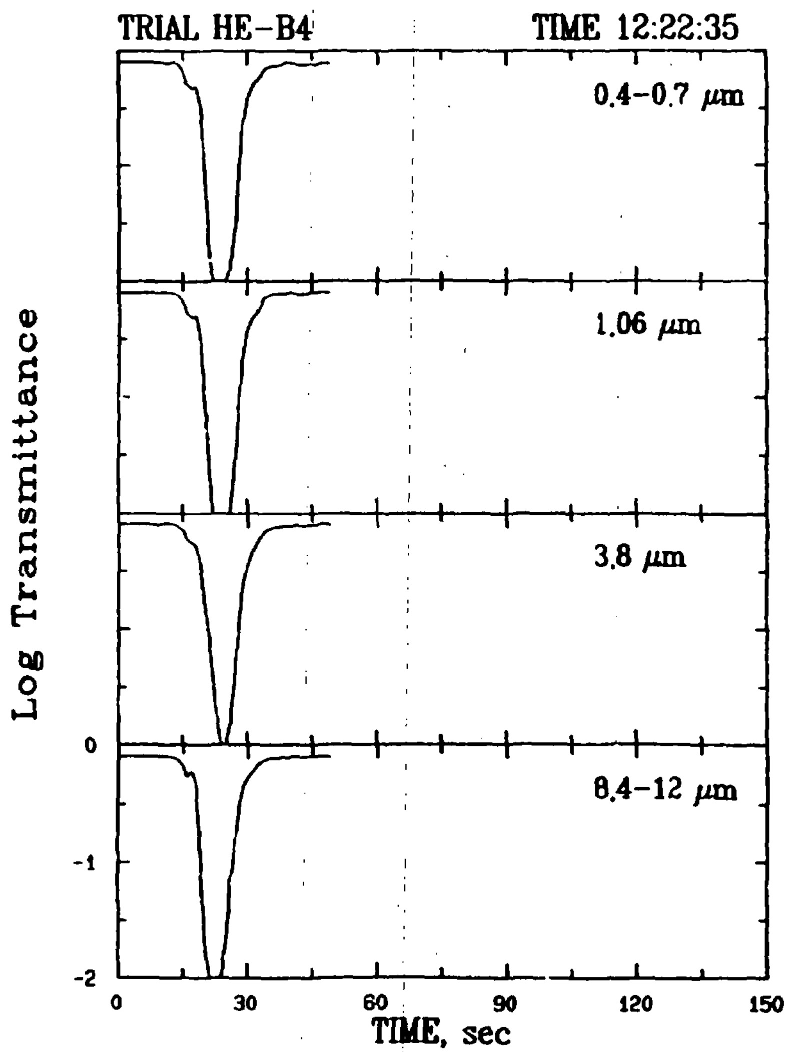
GELMAN DOSAGE (G S/M**3):

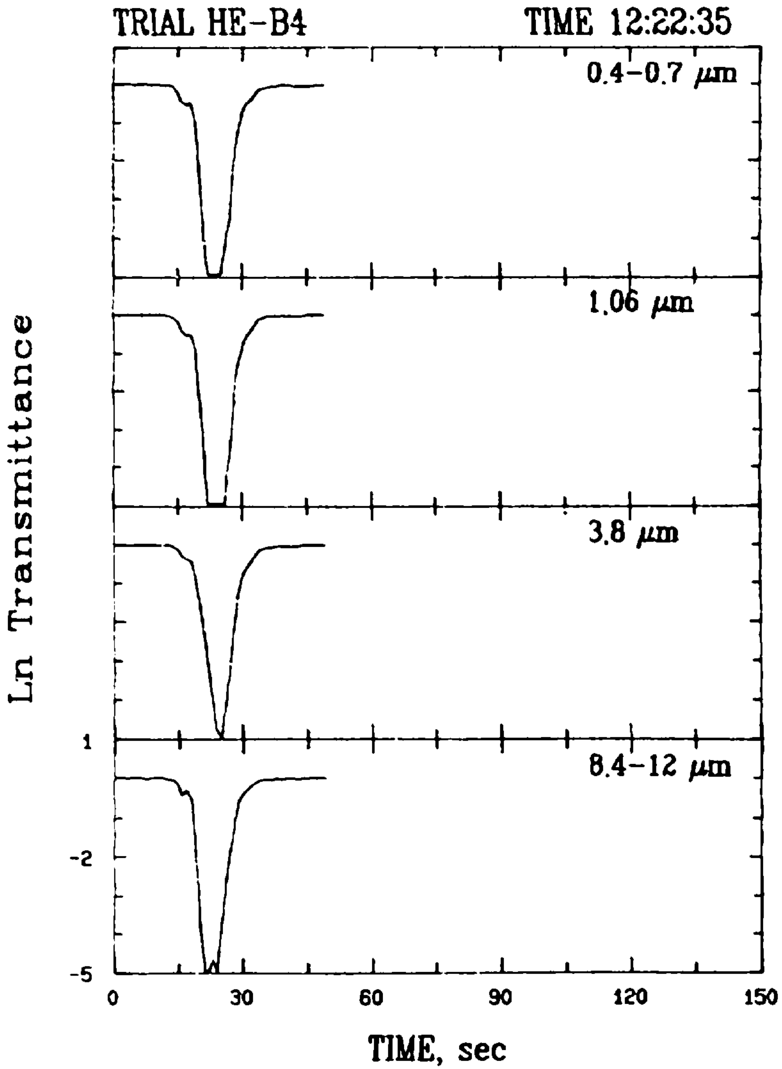
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	4.483	4.865

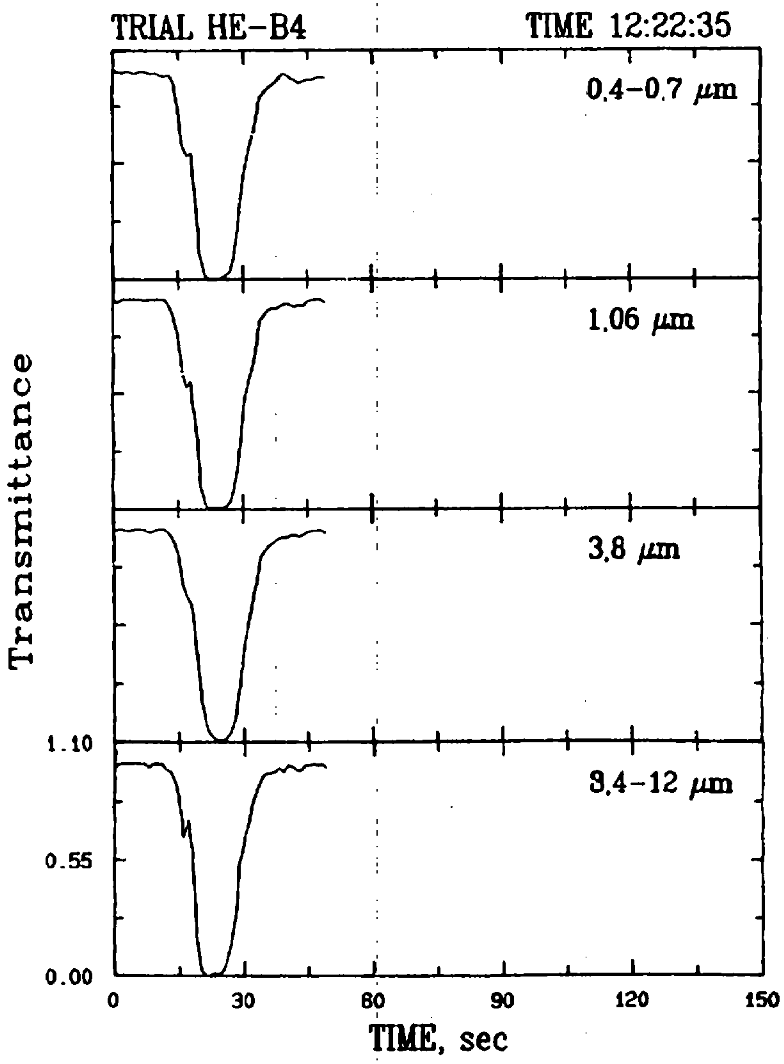

HEB4 . 21 APRIL 83
TRUE NORTH
O .01 GM
EAST-WEST GRID, M
NORTH-SOUTH GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

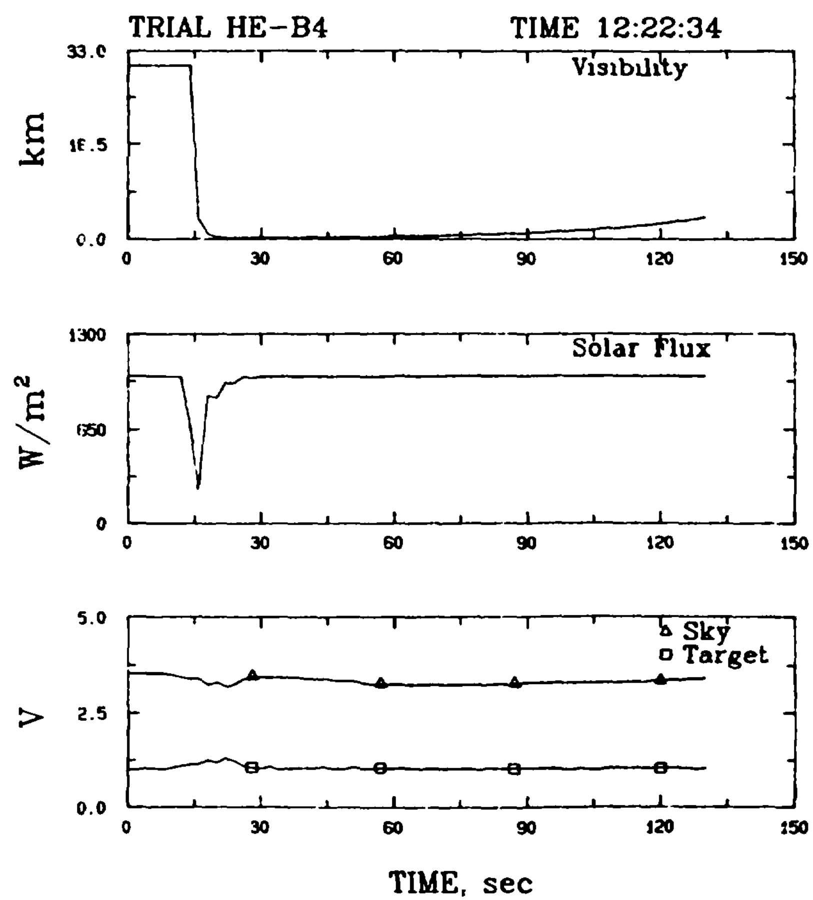

NO DATA FOR B4
DISTANCE, cm
DEPTH, cm
DISTANCE, cm
DEPTH, cm

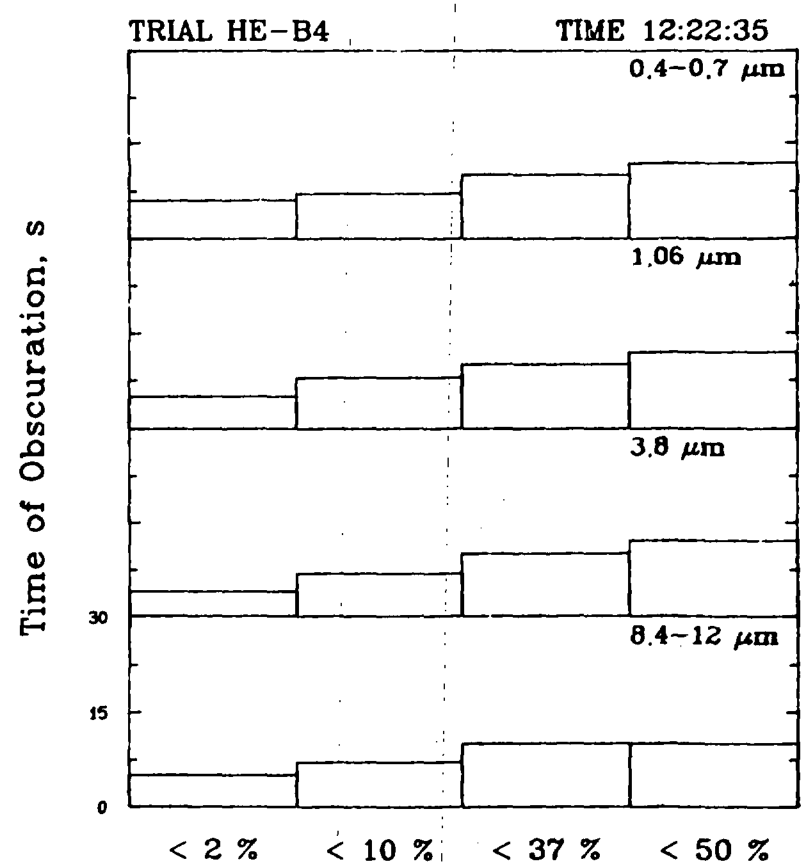

TRIAL HE-B 4
TIME 12:22:44
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B4
TIME 12:22:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Log Transmittance
0
-1
-2
0
30
60
90
120
150
TIME, sec


TRIAL HE-B4
TIME 12:22:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B4
TIME 12:22:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B4
TIME 12:22:34
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec


TRIAL HE-B4
TIME 12:22:35
0.4-0.7 µm
1.06 µm
3.8 µm
8.4-12 µm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB5

Surface Tangent

Date: 21 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 37.9
Y: 18.5

Charge Wt: 15.0 LB
Event Time: 16:58:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: 0.000

16 Meter Tower (Means)
Start Time: 16:57:11 End Time: 17: 1:46

	2M	4M	6M	16M
Wind Speed (M/S)	0.90	0.87	1.02	1.19
Wind Dir. (DEG)	99.6	104.1	103.6	90.1
Sigma WSP	0.20	0.21	0.23	0.36
Sigma WDIR	11.4	11.7	15.5	19.0
UVW Components				
U (N-S) (M/S)	0.15	0.21	0.23	-0.05
V (E-W) (M/S)	-0.87	-0.83	-0.96	-1.13
W (Vert) (M/S)	0.00	0.01	0.01	*
Sigma U	0.18	0.17	0.25	0.36
Sigma V	0.21	0.21	0.24	0.37
Sigma W	0.01	0.04	0.04	*
Temperature (C)	17.4	17.3	17.3	17.3

Soil Temperature (C): 20.2

Solar Flux (W/M**2): 82.9

Dew Point (C): -3.3

Visual Range (M): 30480.0

Temperature (C): 16.4

Vista Ranger Voltages:
Sky: 0.91
Target: 0.40

Rel. Hum. (%): 24.7

Abs. Hum. (G/M**3): 3.47

Sky-Target Contrast: -0.56

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	64.0	29.0	35	129	260	588
Post-Shot	64.0	29.0	25	192	325	485

CRATER DATA

Moisture Content: 11.5

CRATER VOLUMES (M**3):
True Crater: *
Apparent Crater: *
Flow: *

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: 0.925
Bottom: 0.925
Side: 0.926

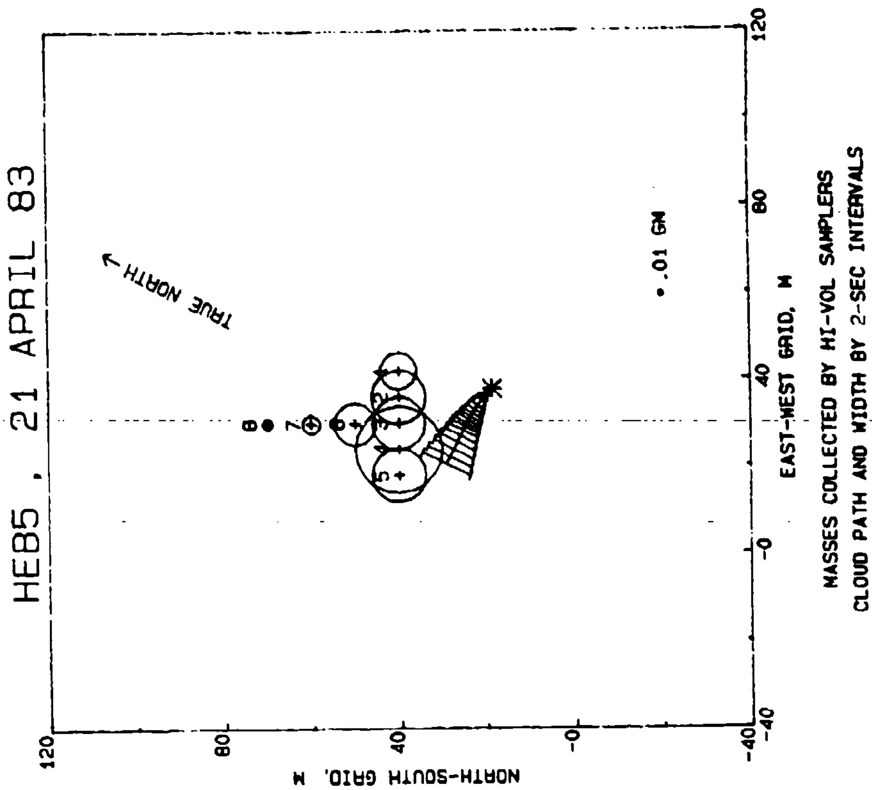
HI VOL DATA (G):

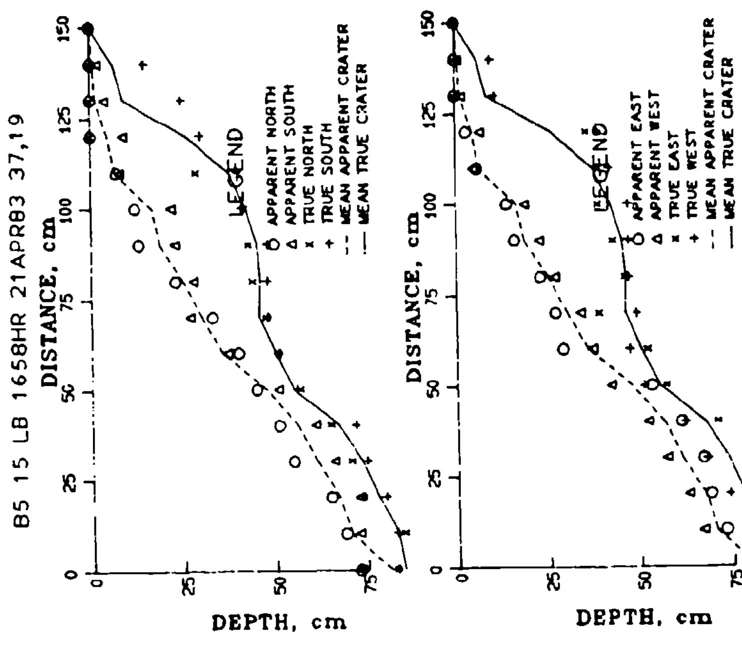
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.5196	1.0856	1.0502	2.8643	1.1068	0.6853	0.1133	0.0482

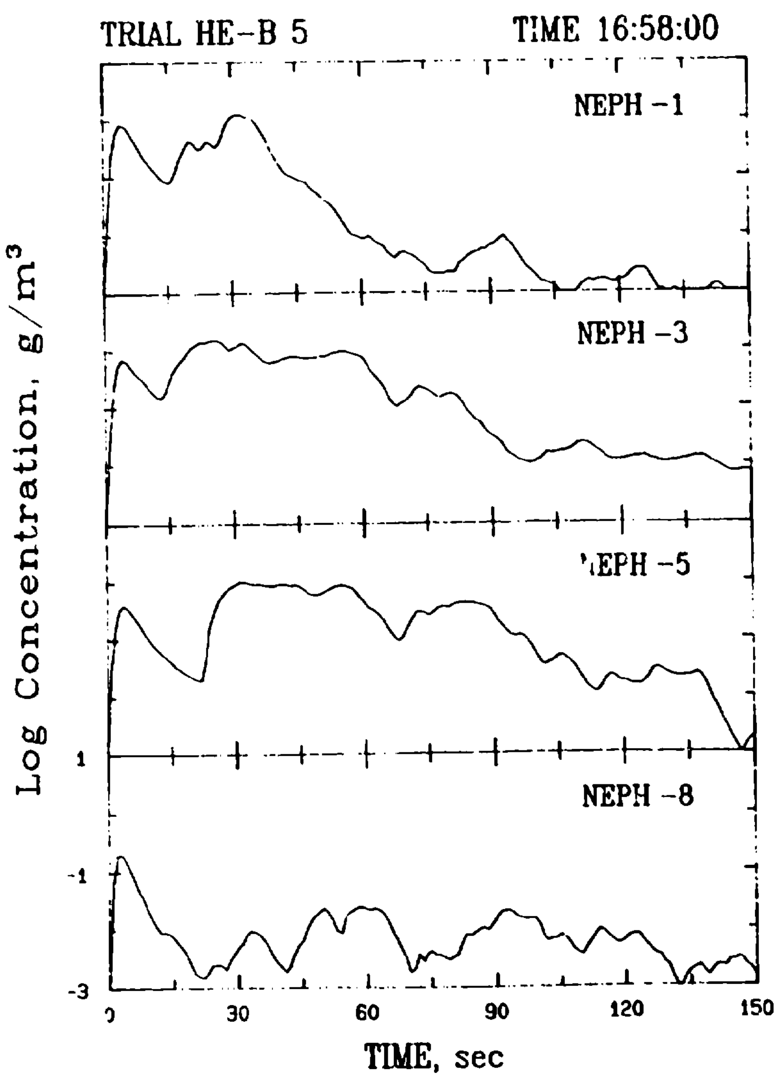
SUM: 7.4733

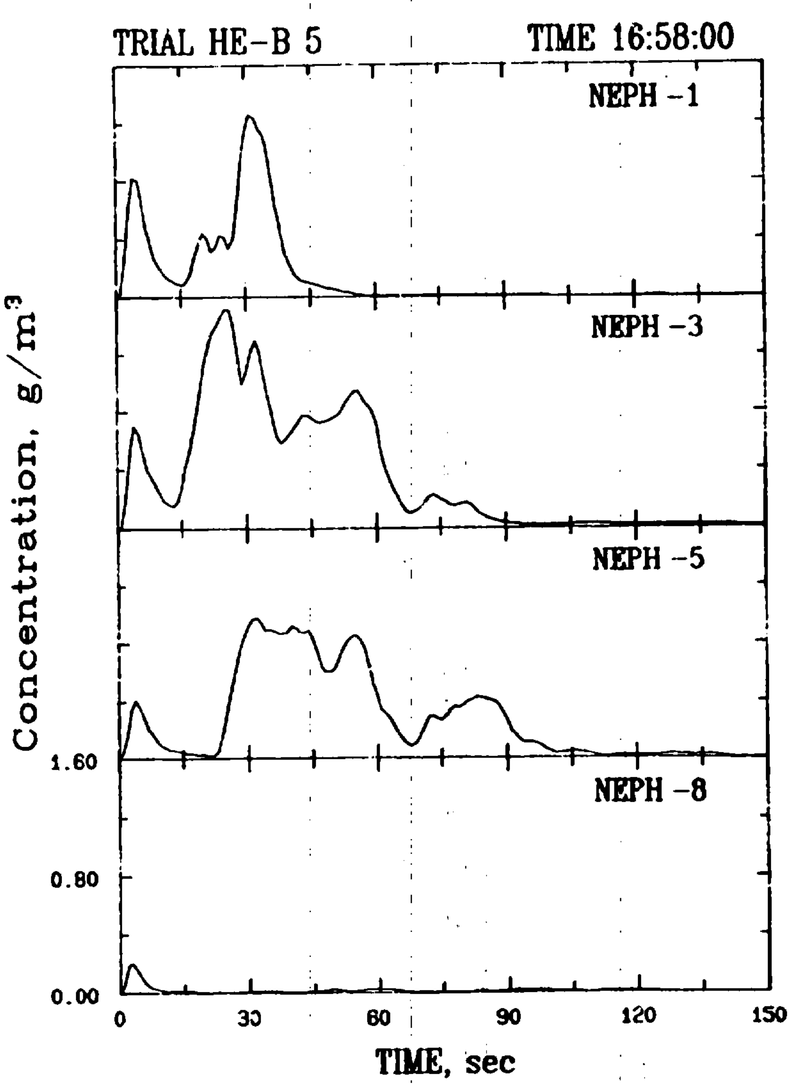
GELMAN DOSAGE (G S/M**3):

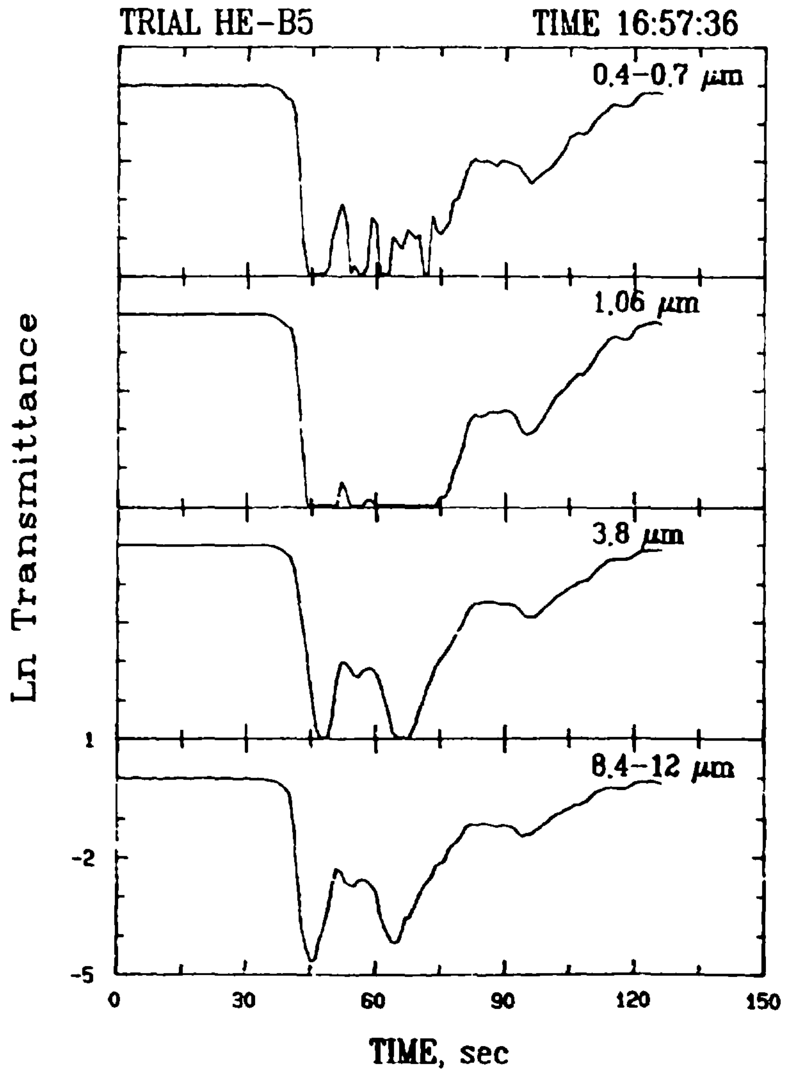
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000


HEB5 . 21 APRIL 83
TRUE NORTH
.01 GM
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

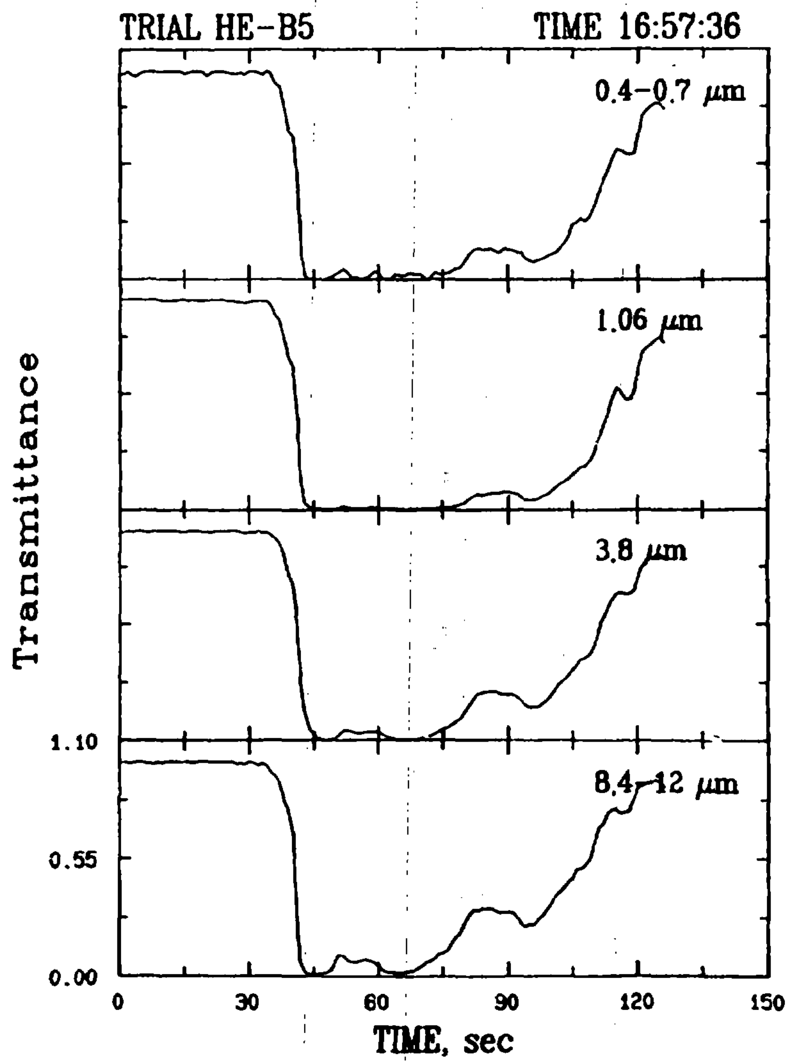

B5 15 LB 1658HR 21APR83 37,19
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT NORTH
APPARENT SOUTH
TRUE NORTH
TRUE SOUTH
MEAN APPARENT CRATER
MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT EAST
APPARENT WEST
TRUE EAST
TRUE WEST
MEAN APPARENT CRATER
MEAN TRUE CRATER


TRIAL HE-B 5
TIME 16:58:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec

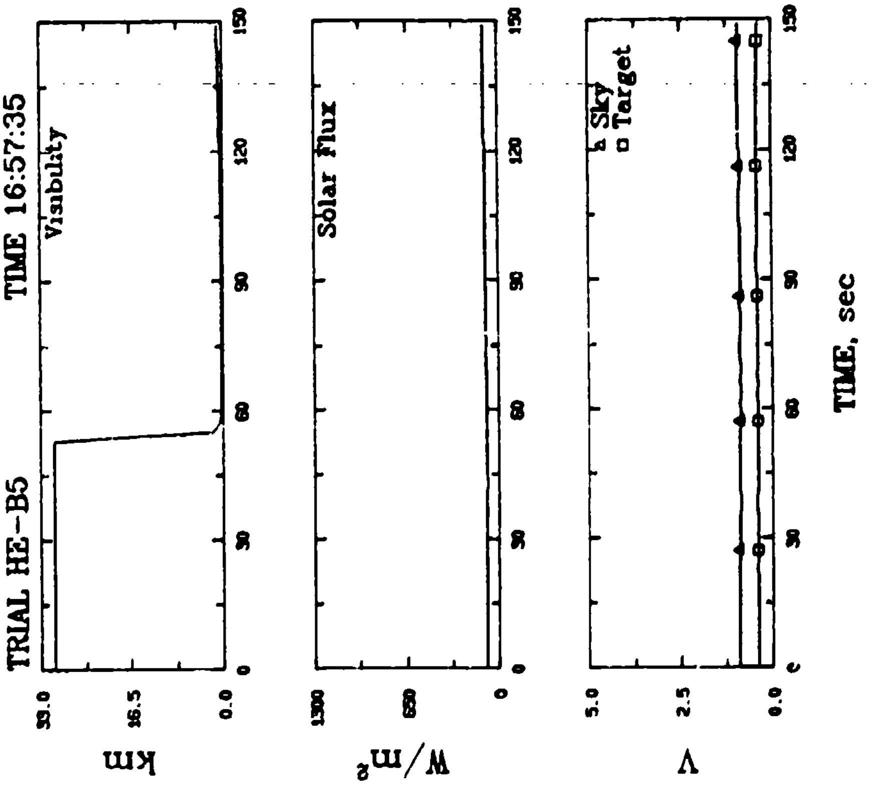

TRIAL HE-B 5
TIME 16:58:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
1.60
0.80
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B5
TIME 16:57:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B5
TIME 16:57:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B5
TIME 16:57:35
Visibility
Solar Flux
Sky
Target
km
W/m²
V
TIME, sec

EVENT SUMMARY DATA

Test Number: HE86

Date: 22 APRIL 83
Detonation Coordinates (M):
X: 61.7
Y: 72.7

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 11:22:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.020

16 Meter Tower (Means)
Start Time: 11:20:49 End Time: 11:24: 1

	2M	4M	6M	16M
Wind Speed (M/S)	6.20	7.07	7.17	8.65
Wind Dir. (DEG)	32.7	29.8	32.3	27.4
Sigma WSP	1.00	1.15	1.08	0.94
Sigma WDIR	10.5	9.4	8.6	7.0
UVW Components				
U (N-S) (M/S)	-5.15	-6.08	-6.01	-7.64
V (E-W) (M/S)	-3.25	-3.42	-3.75	-3.92
W (Vert) (M/S)	0.46	-0.04	0.65	*
Sigma U	1.16	1.30	1.18	1.03
Sigma V	0.96	0.97	0.96	0.95
Sigma W	0.22	0.32	0.34	*
Temperature (C)	11.0	10.9	10.8	10.6

Soil Temperature (C): 11.7

Dew Point (C): 2.7

Temperature (C): 10.2

Rel. Hum. (%): 59.4

Abs. Hum. (G/M**3): 5.69

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 131.5

Visual Range (M): 30400.0

Vista Ranger Voltages:
Sky: *
Target: *

Sky-Target Contrast: *

CONE INDEX:

	X,Y Coord (M)	SPC	15	30	45
Pre-Shot	62.0 73.0	26	192	308	667
Post-Shot	62.0 73.0	25	70	130	195

CRATER DATA

Moisture Content: 13.1

CRATER VOLUMES (M**3):
True Crater: 1.260
Apparent Crater: 0.231
Flow: 1.029

DENSITIES (G/CM**3):
Pre-Shot: 1.380
Flow: 1.040
Bottom: 0.975
Side: 1.104

HI VOL DATA (G):

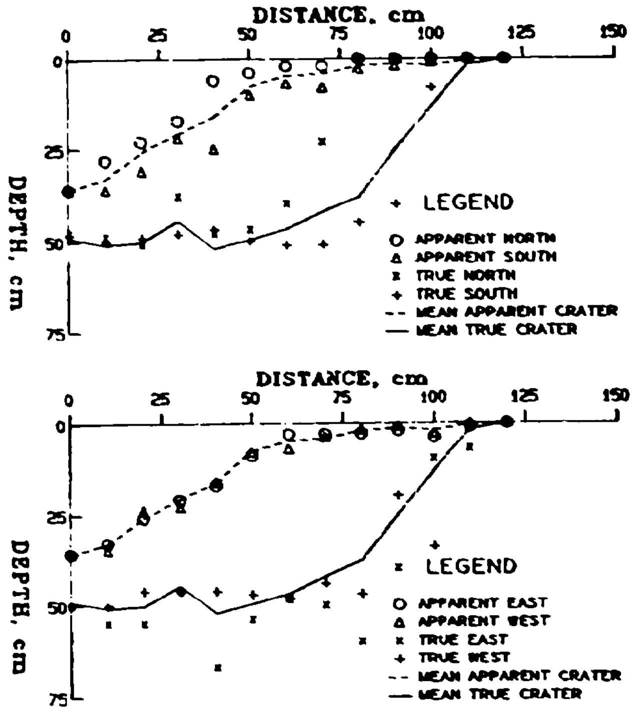
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0147	0.0693	0.1081	0.1129	6.0968	0.2123	0.0049	0.0059

SUM: 0.6249

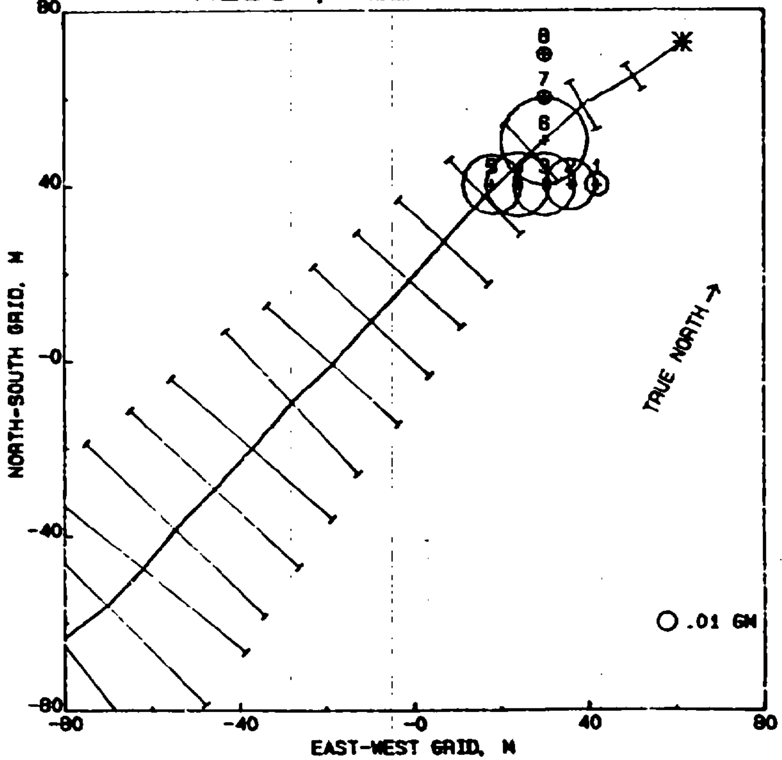
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
16.114	55.200	76.961	67.568

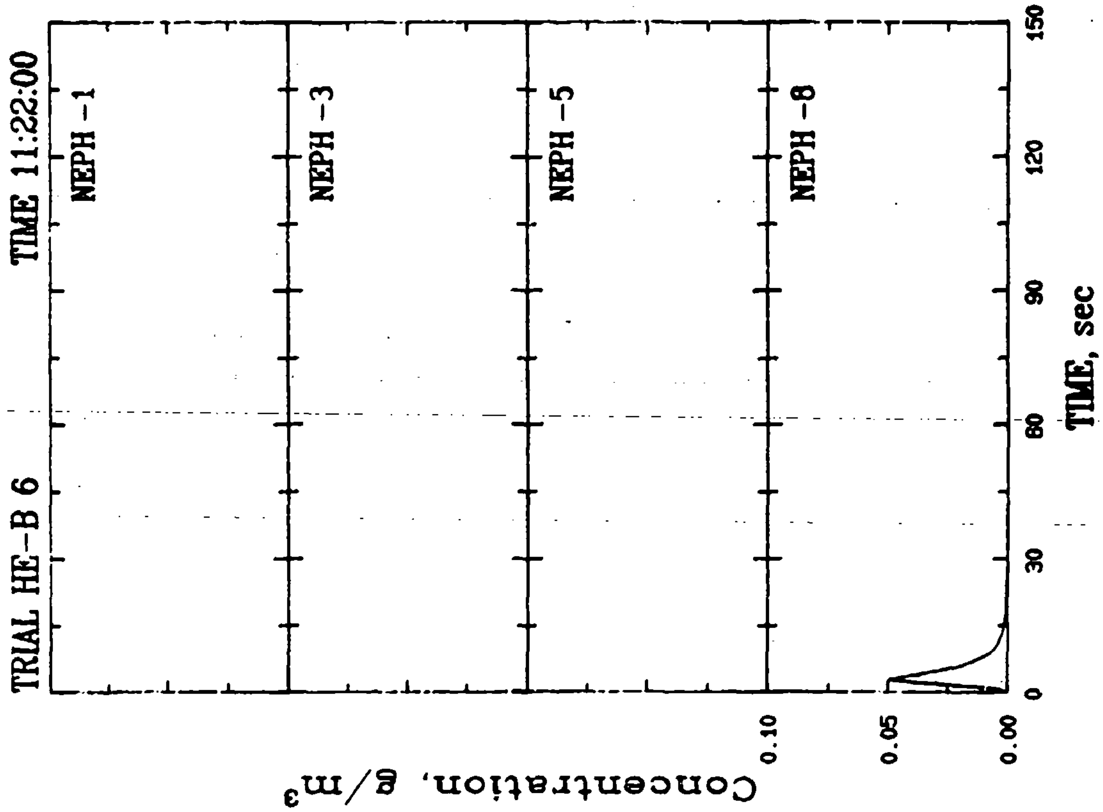
B6 15 LB 1122HR 22APR83 62,73



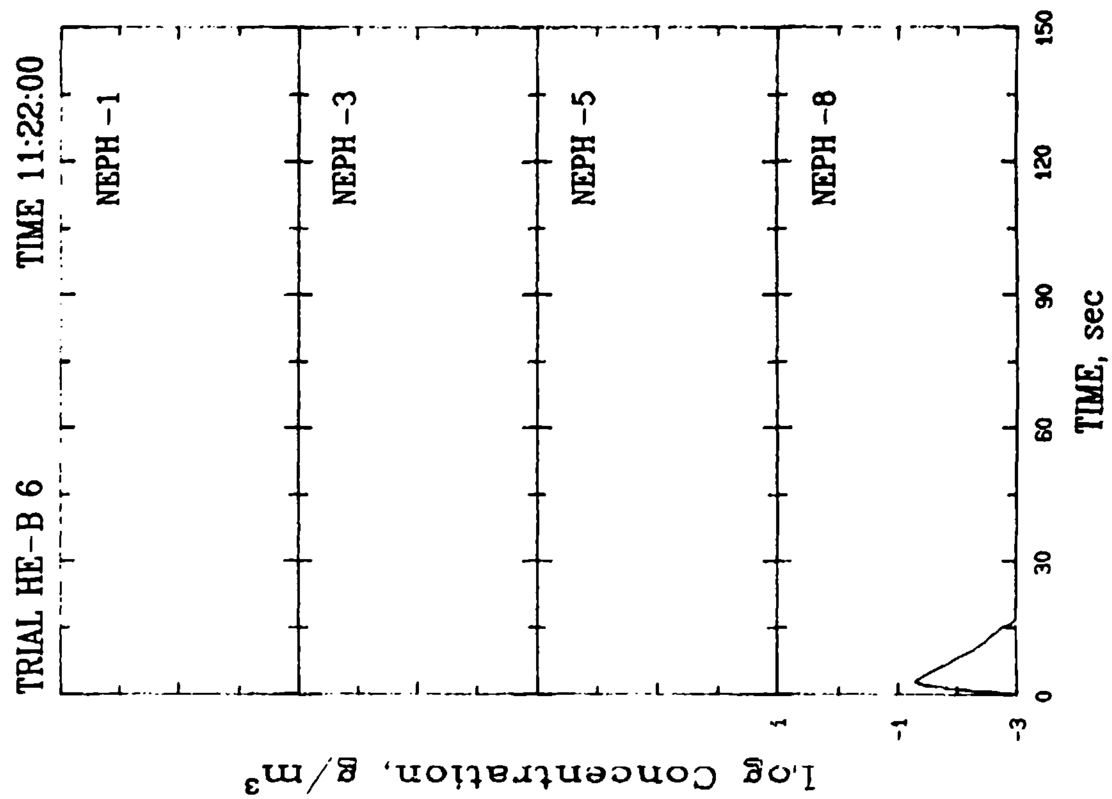
HEB6 , 22 APRIL 83



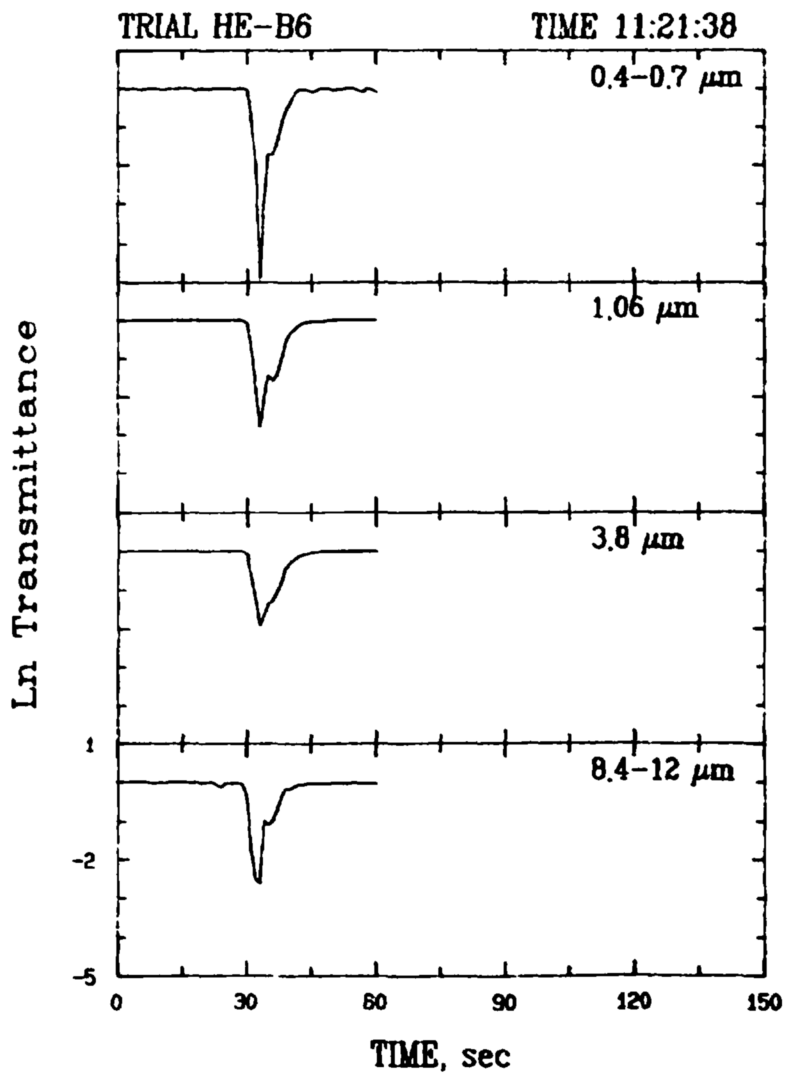
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

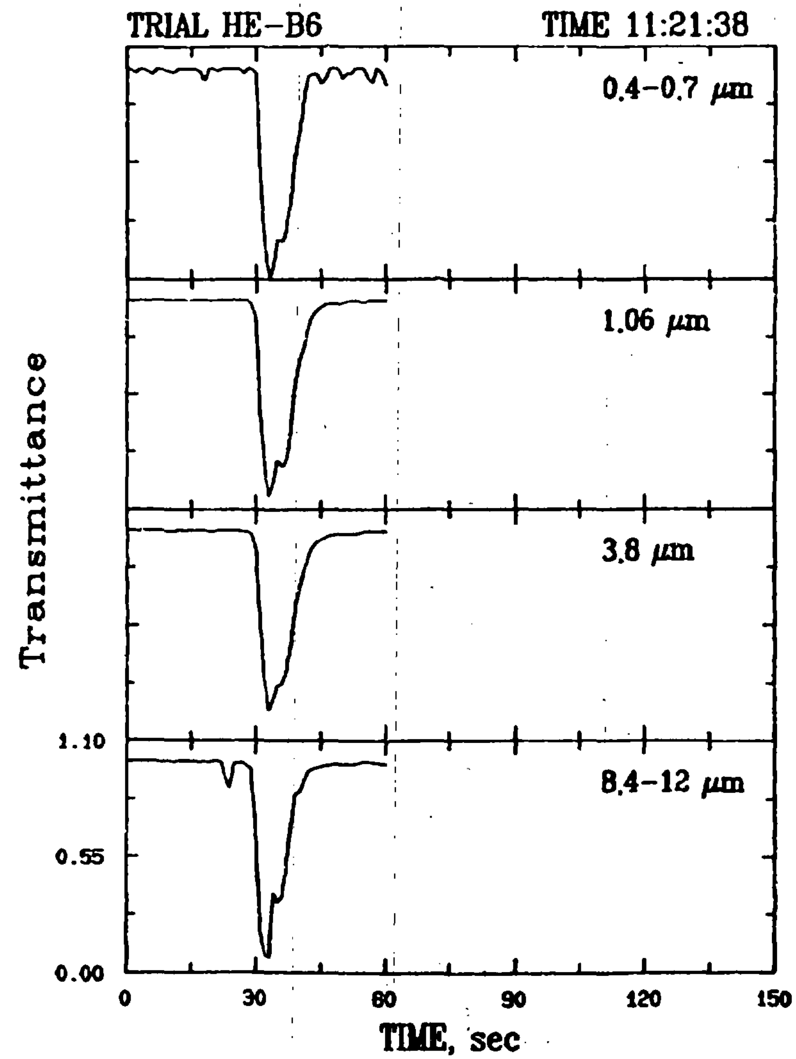


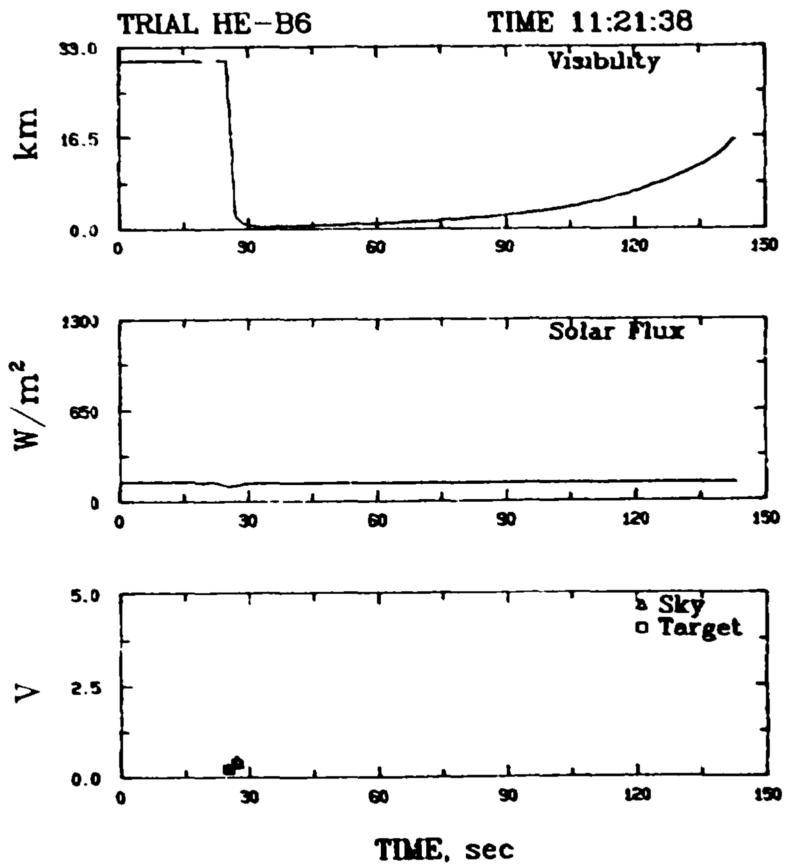
TRIAL HE-B 6
TIME 11:22:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
0.10
0.05
0.00
Concentration, g/m³
0
30
60
90
120
150
TIME, sec



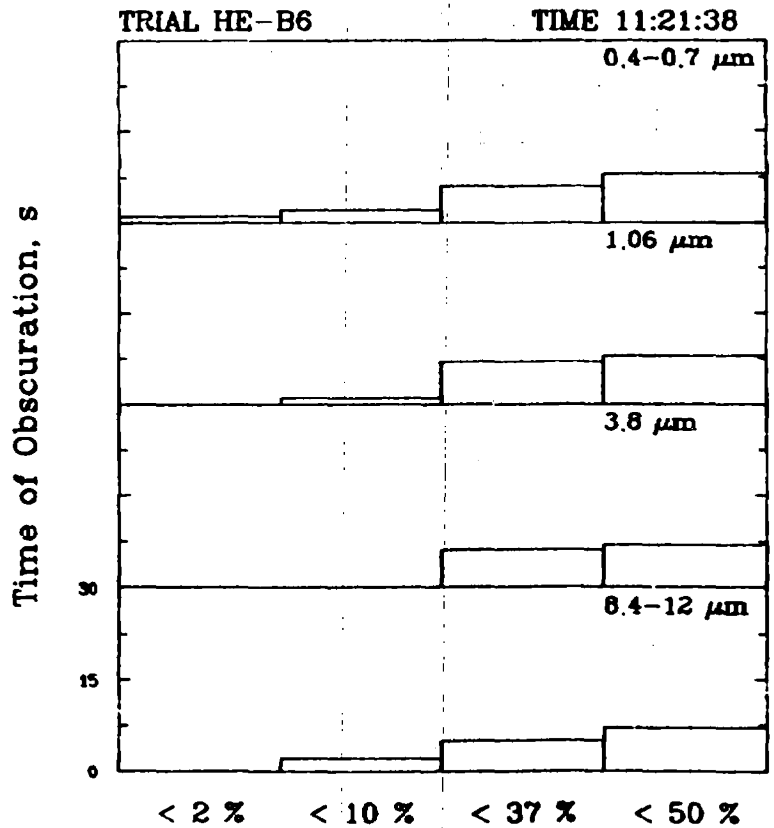
TRIAL HE-B 6
TIME 11:22:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
1
-1
-3
Log Concentration, g/m³
0
30
60
90
120
150
TIME, sec


TRIAL HE-B6
TIME 11:21:38
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B6
TIME 11:21:38
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B6
TIME 11:21:38
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-B6
TIME 11:21:38
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB7

Date: 22 APRIL 83
Detonation Coordinates (M):
X: 80.9
Y: 69.1

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 15:41:00

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.026

16 Meter Tower (Means)
Start Time: 15:31:17 End Time: 15:43: 2

	2M	4M	6M	16M
Wind Speed (M/S)	8.79	10.27	10.28	12.10
Wind Dir. (DEG)	29.7	27.0	31.0	27.1
Sigma WSP	1.47	1.65	1.62	1.65
Sigma WDIR	7.5	6.6	6.8	5.4
UVW Components				
U (N-S) (M/S)	-7.61	-9.12	-8.79	=10.7
V (E-W) (M/S)	-4.26	-4.57	-5.20	-5.43
W (Vert) (M/S)	0.69	0.20	1.08	*
Sigma U	1.57	1.74	1.72	1.73
Sigma V	1.01	1.64	1.07	1.03
Sigma W	0.29	0.39	0.33	*
Temperature (C)	11.1	10.9	10.8	10.4

Soil Temperature (C): 14.5

Dew Point (C): 2.6

Temperature (C): 10.7

Rel. Hum. (%): 57.5

Abs. Hum. (G/M**3): 5.66

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 190.1

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 0.49
Target: 0.39

Sky-Target Contrast: -0.22

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	81.0	69.0	38	280	258	375
Post-Shot	81.0	69.0	50	88	138	446

CRATER DATA

Moisture Content: 11.8

CRATER VOLUMES (M**3):
True Crater: 0.840
Apparent Crater: 0.230
Flow: 0.610

DENSITIES (G/CM**3):
Pre-Shot: 1.280
Flow: 1.138
Bottom: 1.095
Side: 1.181

HI VOL DATA (G):

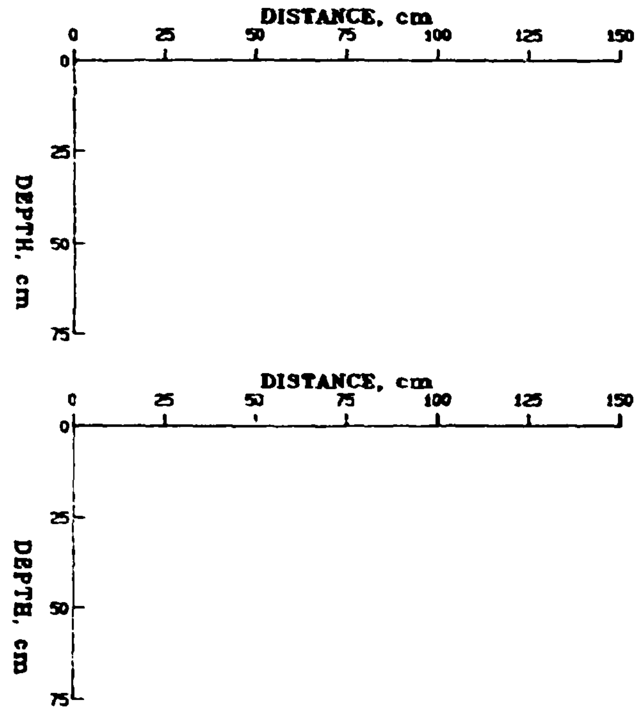
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0000	0.1486	0.2105	0.2168	0.1558	0.0945	0.0502	0.0200

SUM: 0.8964

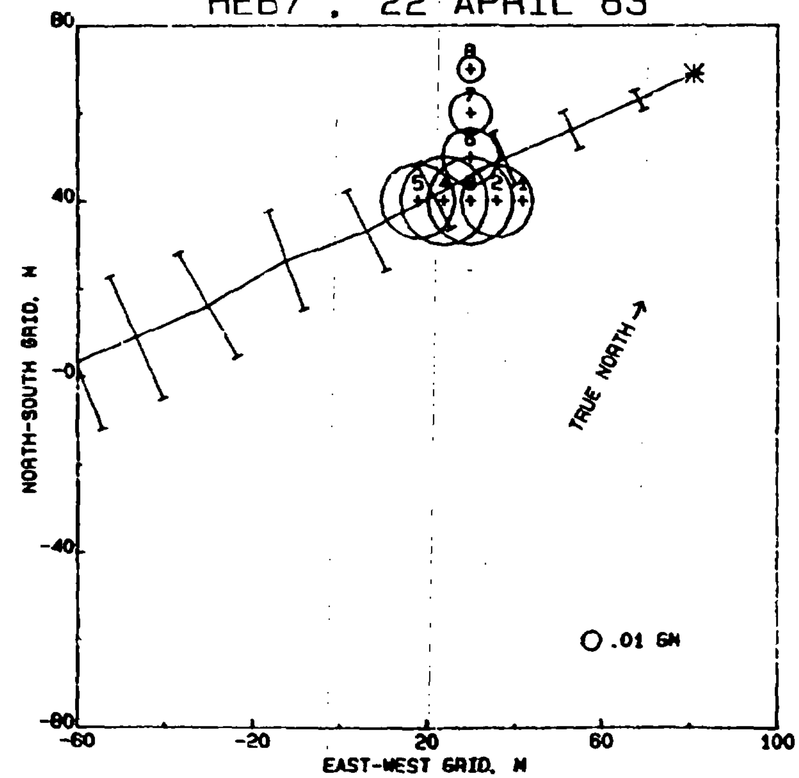
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	49.600	91.905	103.243

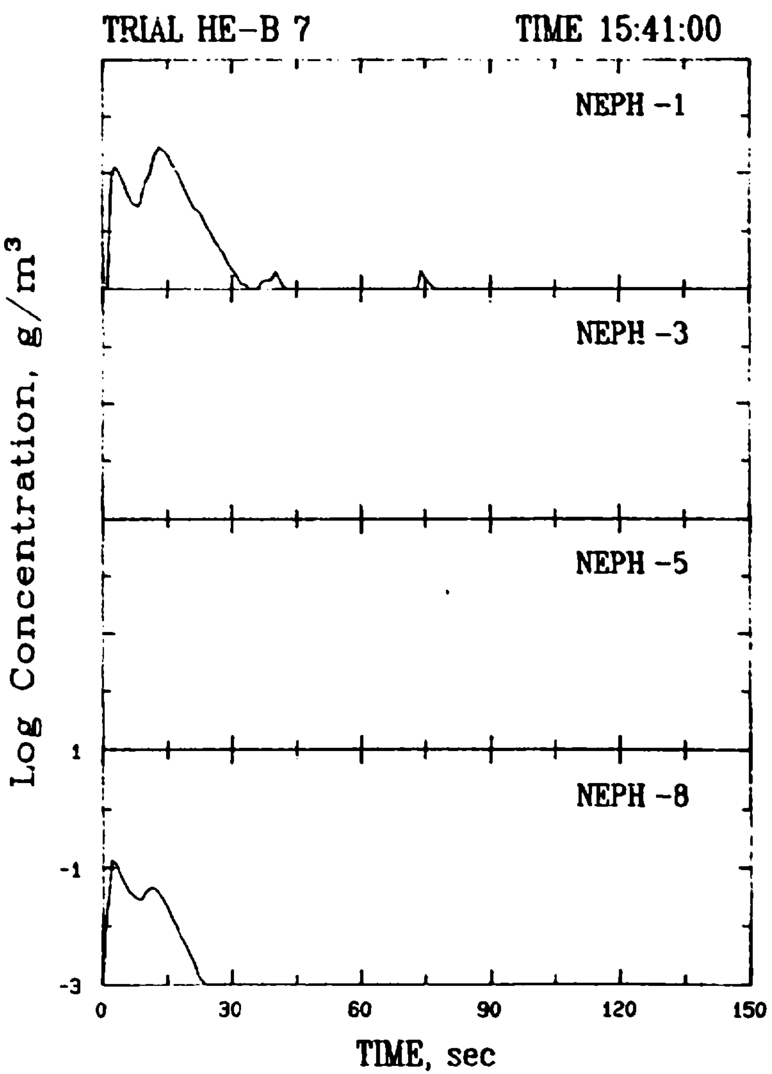
NO DATA FOR B7



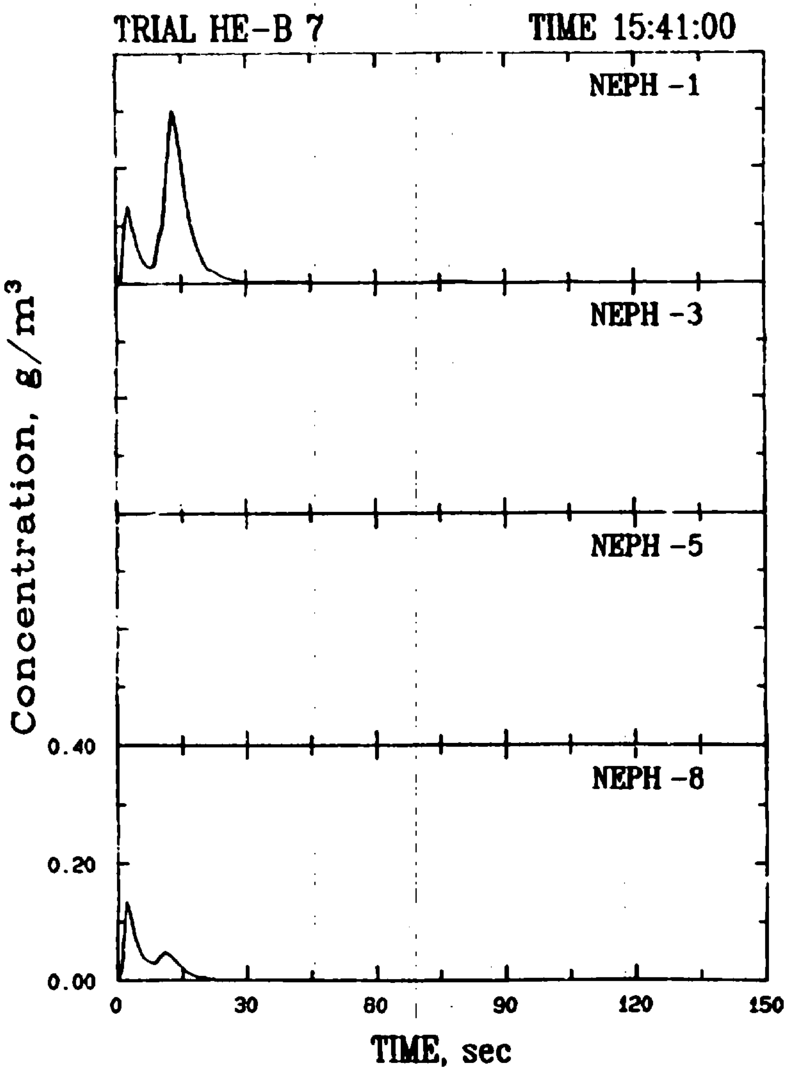
HEB7 . 22 APRIL 83



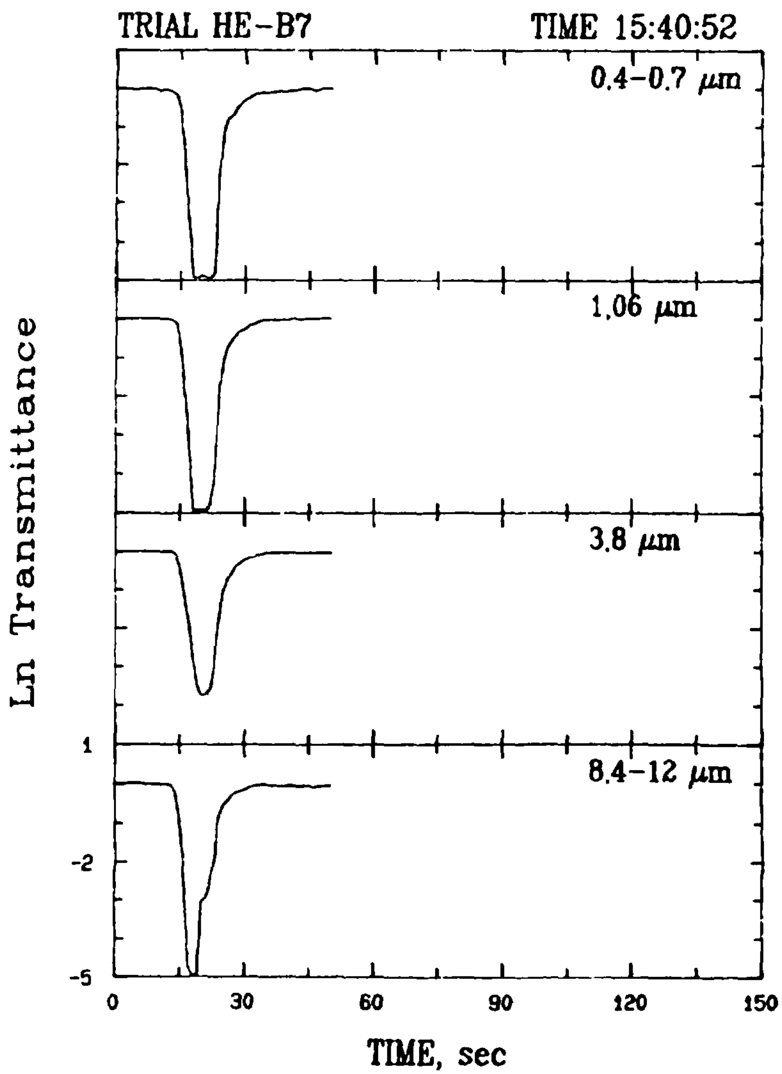
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

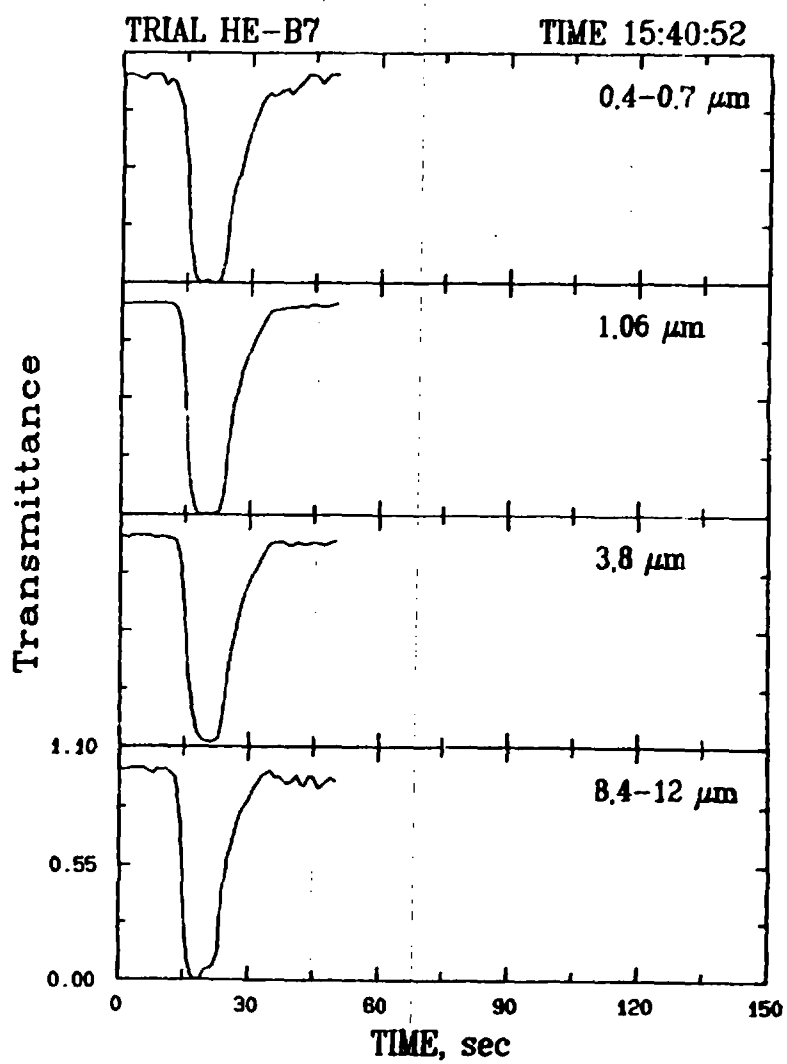


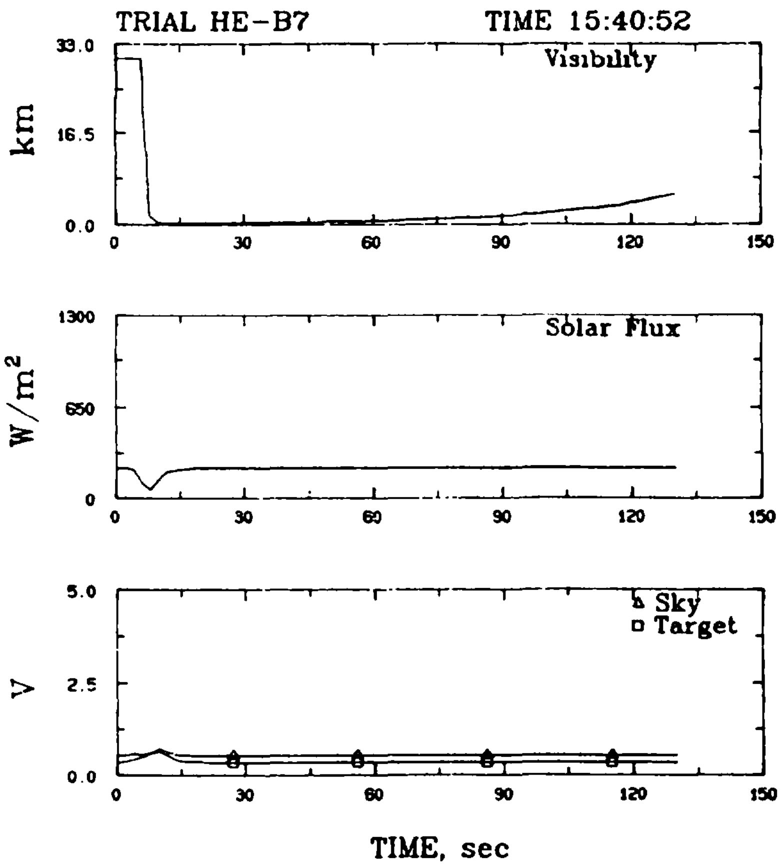
TRIAL HE-B 7
TIME 15:41:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



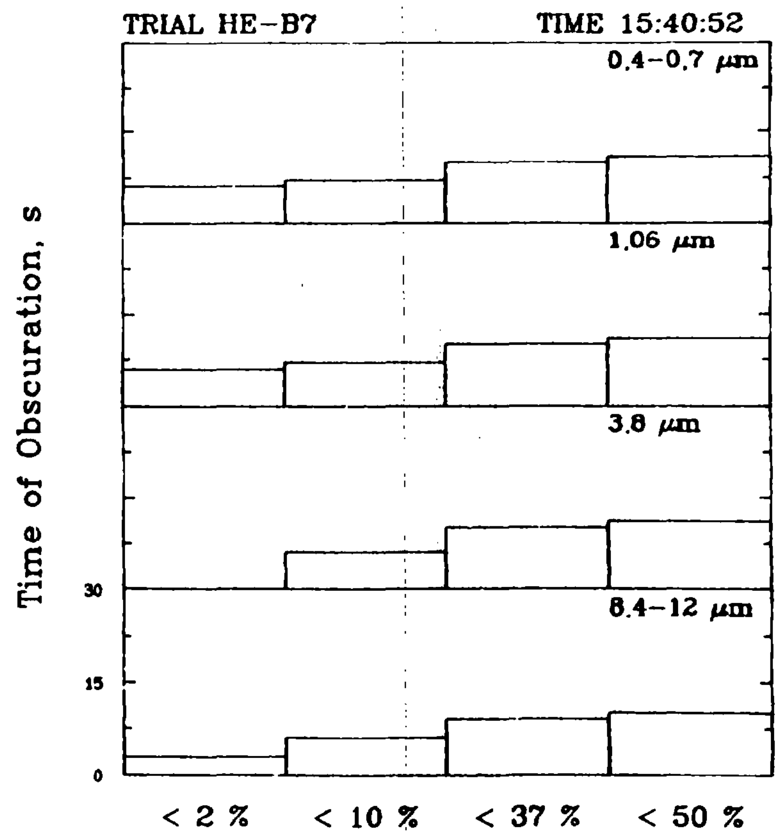
TRIAL HE-B 7
TIME 15:41:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.40
0.20
0.00
0
30
80
90
120
150
TIME, sec


TRIAL HE-B7
TIME 15:40:52
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B7
TIME 15:40:52
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B7
TIME 15:40:52
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec



TRIAL HE-B7
TIME 15:40:52
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB8

Surface Tangent

Date: 23 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 53.5
Y: 18.3

Charge Wt: 15.0 LB
Event Time: 11:38:00

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -5.758

16 Meter Tower (Means)
Start Time: 11:34:44   End Time: 11:40: 7

	2M	4M	6M	16M
Wind Speed (M/S)	3.99	4.16	4.40	4.97
Wind Dir. (DEG)	114.4	113.9	114.2	110.6
Sigma WSP	1.05	1.08	1.24	1.53
Sigma WDIR	22.3	22.0	20.9	23.0
UVW Components				
U (N-S) (M/S)	1.40	1.45	1.53	1.51
V (E-W) (M/S)	-3.44	-3.60	-3.85	-4.34
W (Vert) (M/S)	0.27	0.32	0.40	*
Sigma U	1.15	1.29	1.22	1.71
Sigma V	1.37	1.35	1.50	1.73
Sigma W	0.20	0.28	0.39	*
Temperature (C)	14.9	14.0	13.8	13.3

Soil Temperature (C): 26.6

Solar Flux (W/M**2): 782.4

Dew Point (C): 2.8

Visual Range (M): 30480.0

Temperature (C): 13.9

Vista Ranger Voltages:
Sky: 1.54
Target: 1.39

Rel. Hum. (%): 47.2

Abs. Hum. (G/M**3): 5.67

Sky-Target Contrast: -0.10

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SPC	15	30	45
Pre-Shot	54.0	18.0	100	258	225	433
Post-Shot	54.0	18.0	50	90	145	240

CRATER DATA

Moisture Content: 12.4

CRATER VOLUMES (M**3):
True Crater: 0.930
Apparent Crater: 0.335
Flow: 0.594

DENSITIES (G/CM**3):
Pre-Shot: 1.430
Flow: 1.127
Bottom: 1.136
Side: 1.118

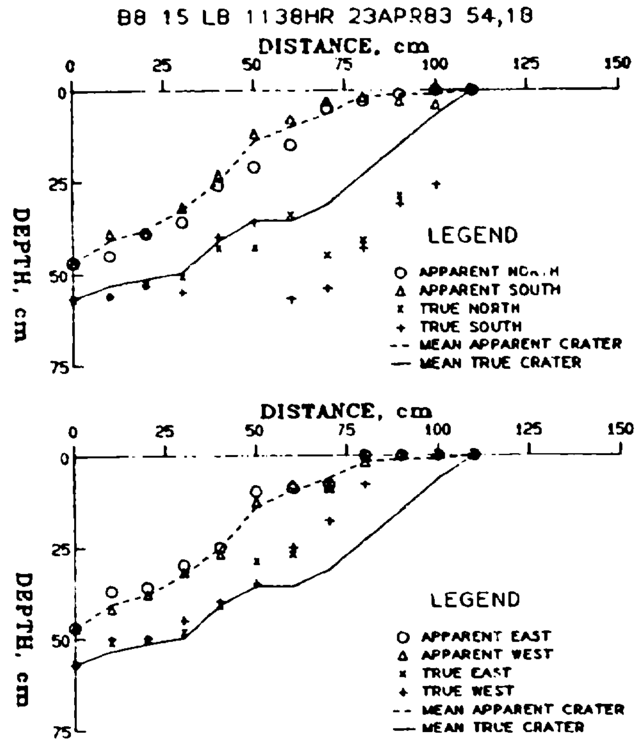
HI VOL DATA (G):

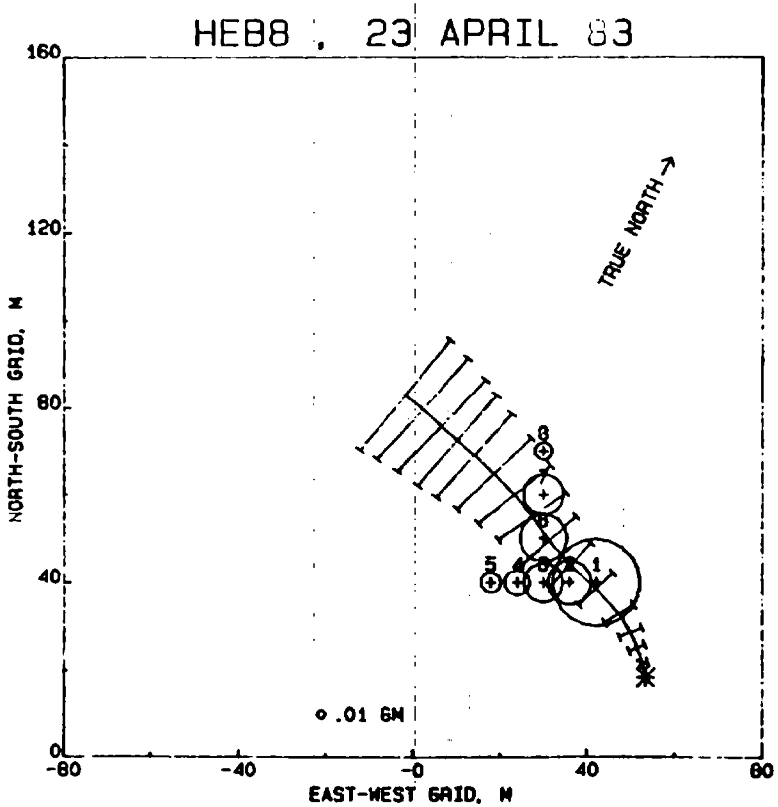
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
1.0707	0.2778	0.2178	0.0881	0.0578	0.3186	0.2340	0.0455

SUM: 2.3103

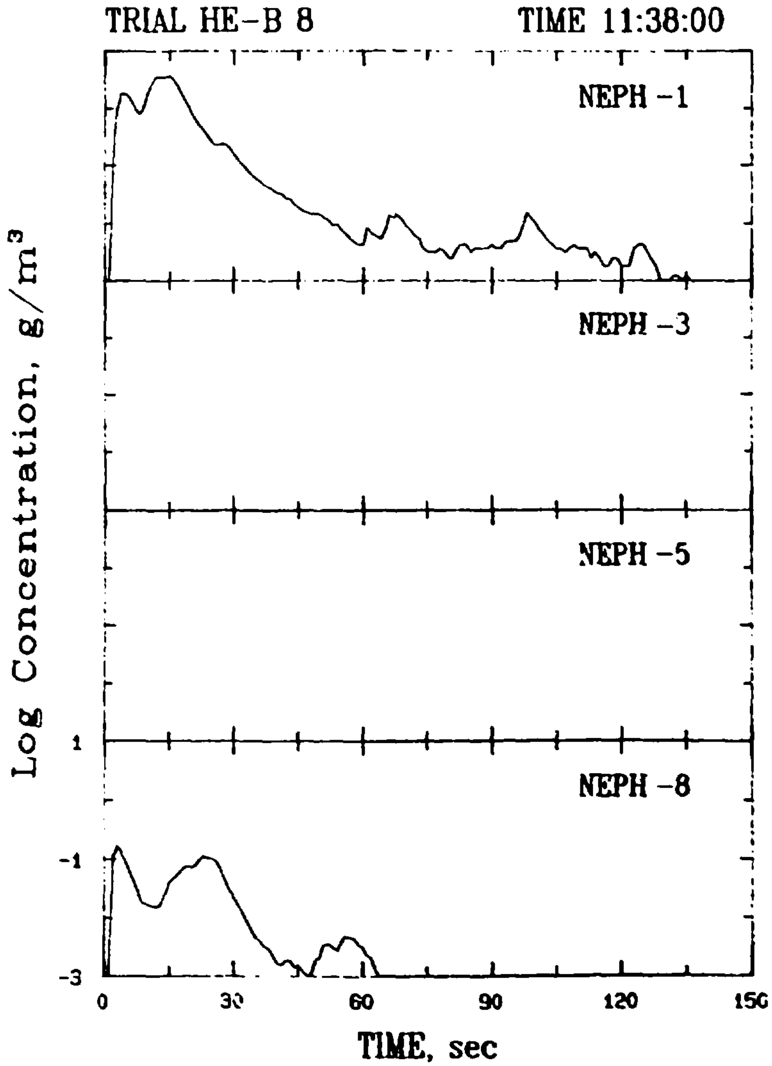
GELMAN DOSAGE (G S/M**3):

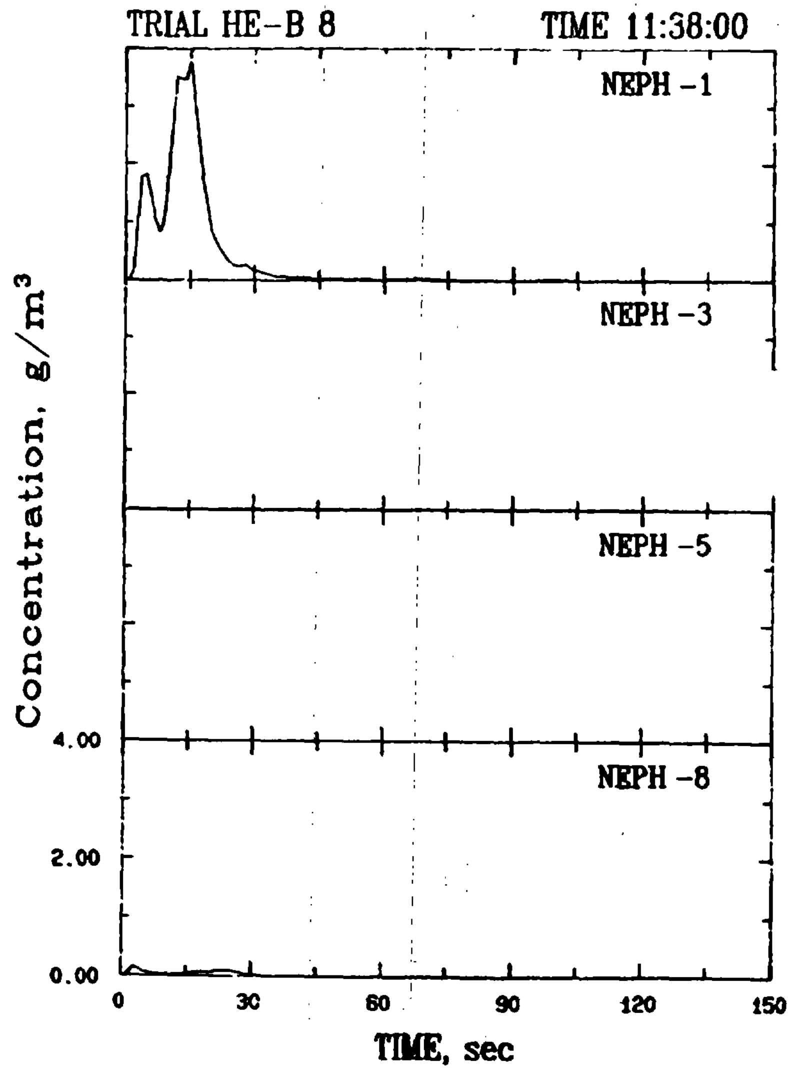
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

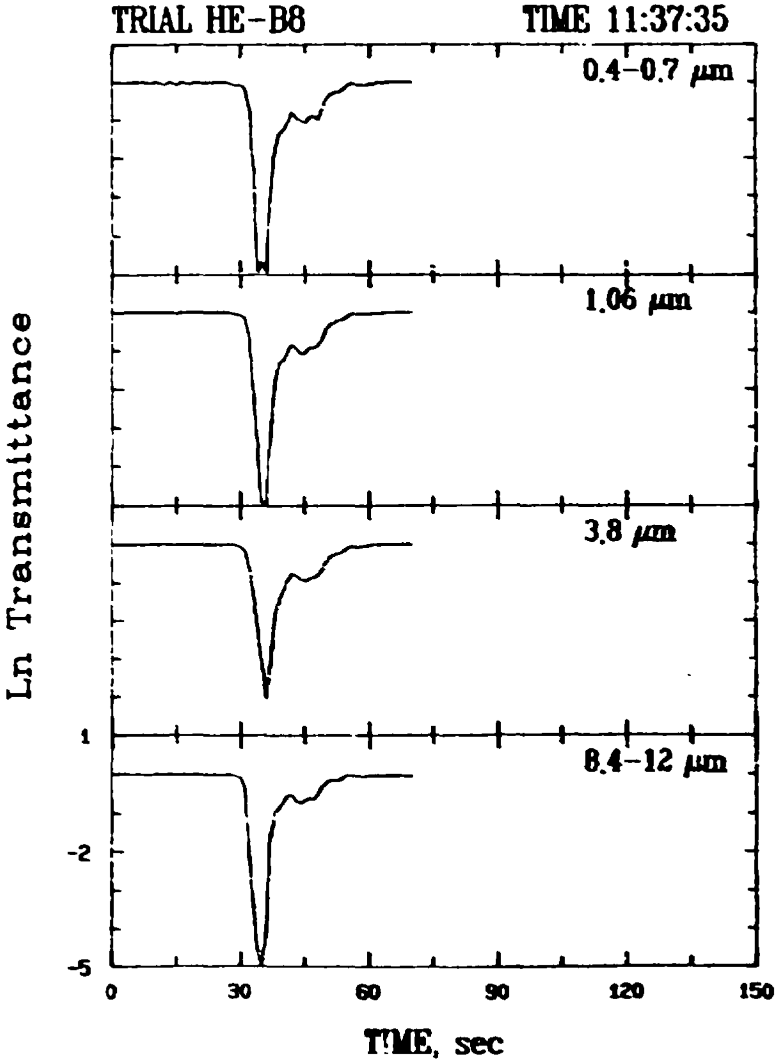




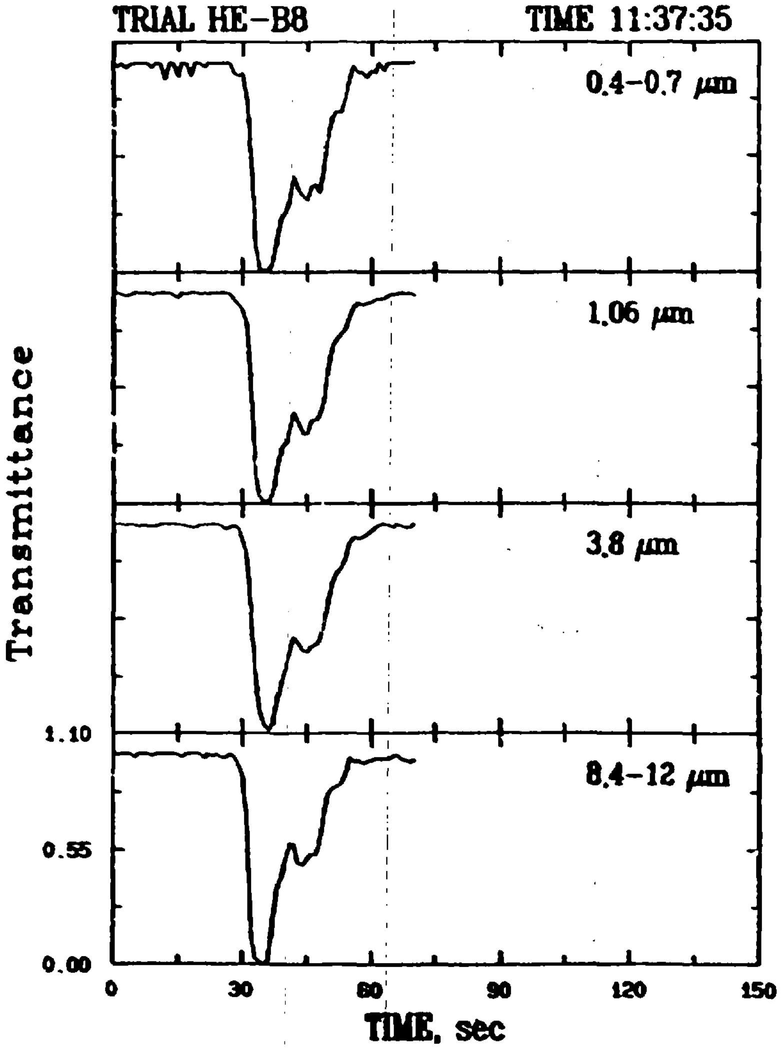
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B 8
TIME 11:38:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec

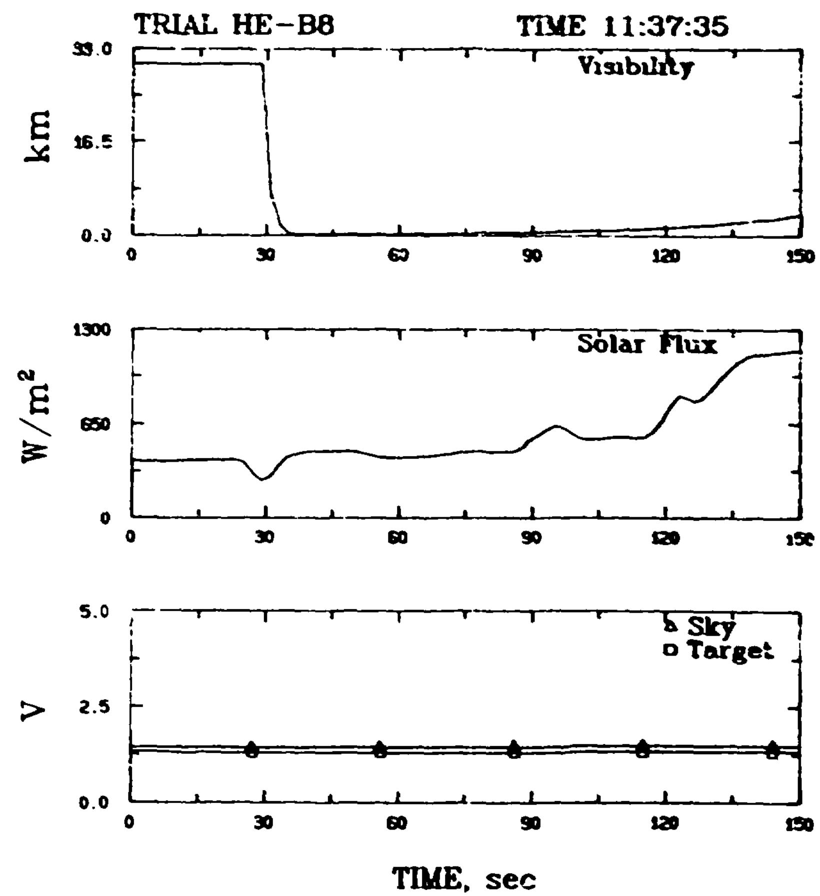

TRIAL HE-B 8
TIME 11:38:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
4.00
2.00
0.00
0
30
60
90
120
150
TIME, sec



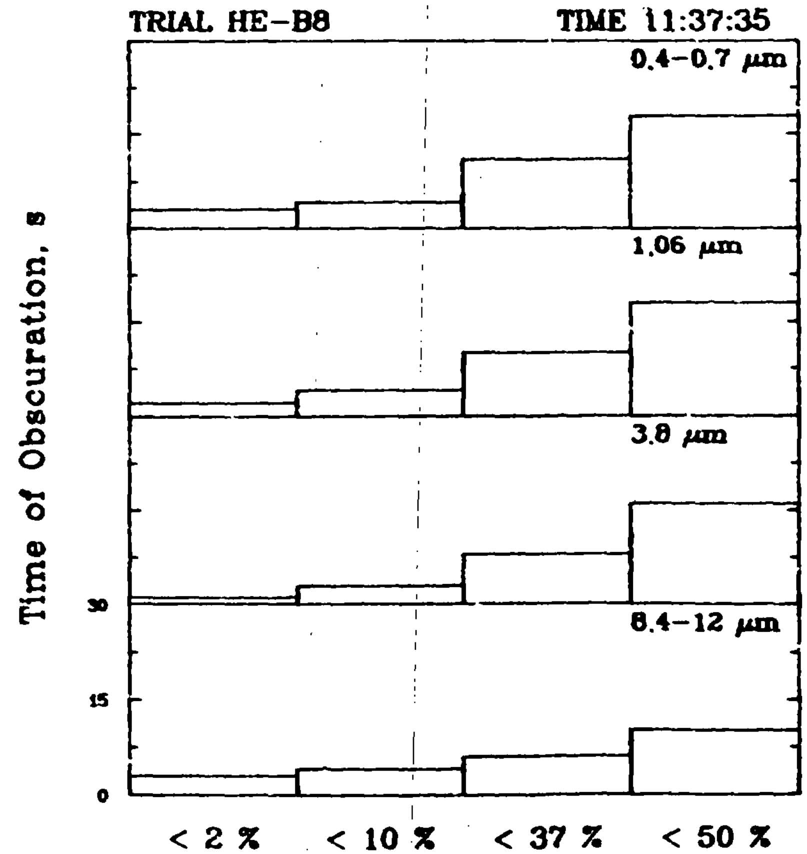
TRIAL HE-B8
TIME 11:37:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B8
TIME 11:37:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B8
TIME 11:37:35
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



TRIAL HE-B8
TIME 11:37:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEB9

Date: 23 APRIL 83
Detonation Coordinates (M):
X: 88.9
Y: -0.6

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 14:51:57

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.602

16 Meter Tower (Means)
Start Time: 14:48:35 End Time: 14:54: 0

	2M	4M	6M	16M
Wind Speed (M/S)	3.61	3.77	4.12	4.64
Wind Dir. (DEG)	95.2	94.9	96.9	97.5
Sigma WSP	1.36	1.32	1.45	1.36
Sigma WDIR	21.6	22.8	21.5	20.1
UVW Components				
U (N-S) (M/S)	0.60	0.64	0.81	0.90
V (E-W) (M/S)	-3.35	-3.48	-3.81	-4.31
W (Vert) (M/S)	0.22	0.18	0.20	*
Sigma U	1.30	1.42	1.46	1.58
Sigma V	1.26	1.22	1.33	1.23
Sigma W	0.24	0.29	0.31	*
Temperature (C)	15.3	14.8	14.5	14.4

Soil Temperature (C): 24.2

Dew Point (C): 2.2

Temperature (C): 14.3

Rel. Hum. (%): 44.0

Abs. Hum. (G/M**3): 5.44

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 267.0

Visual Range (M): 30400.0

Vista Ranger Voltages:
Sky: 1.24
Target: 1.04

Sky-Target Contrast: -0.17

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	89.0	0.0	50	245	615	750+
Post-Shot	89.0	0.0	50	290	635	750+

CRATER DATA

Moisture Content: 12.9

CRATER VOLUMES (M**3):
True Crater: 0.529
Apparent Crater: 0.221
Flow: 0.308

DENSITIES (G/CM**3):
Pre-Shot: 1.420
Flow: 1.135
Bottom: *
Side: *

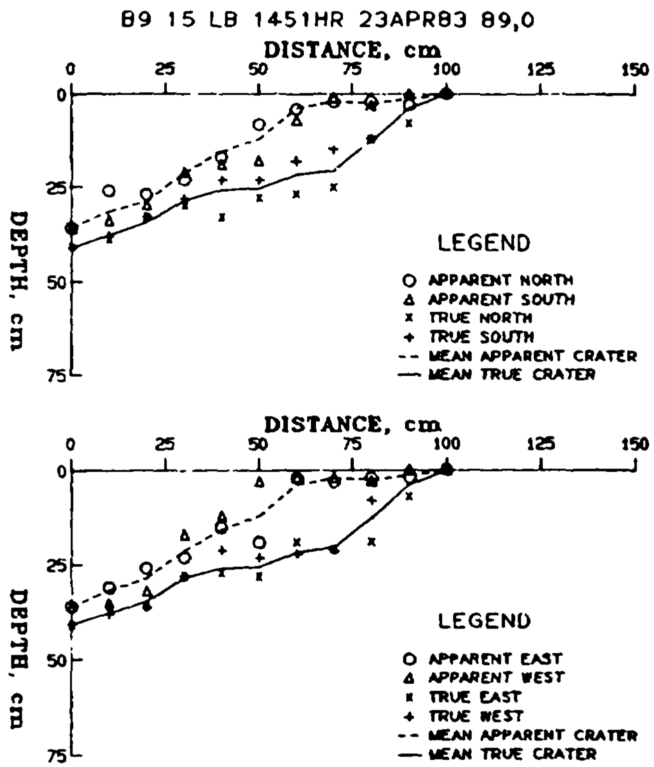
HI VOL DATA (G):

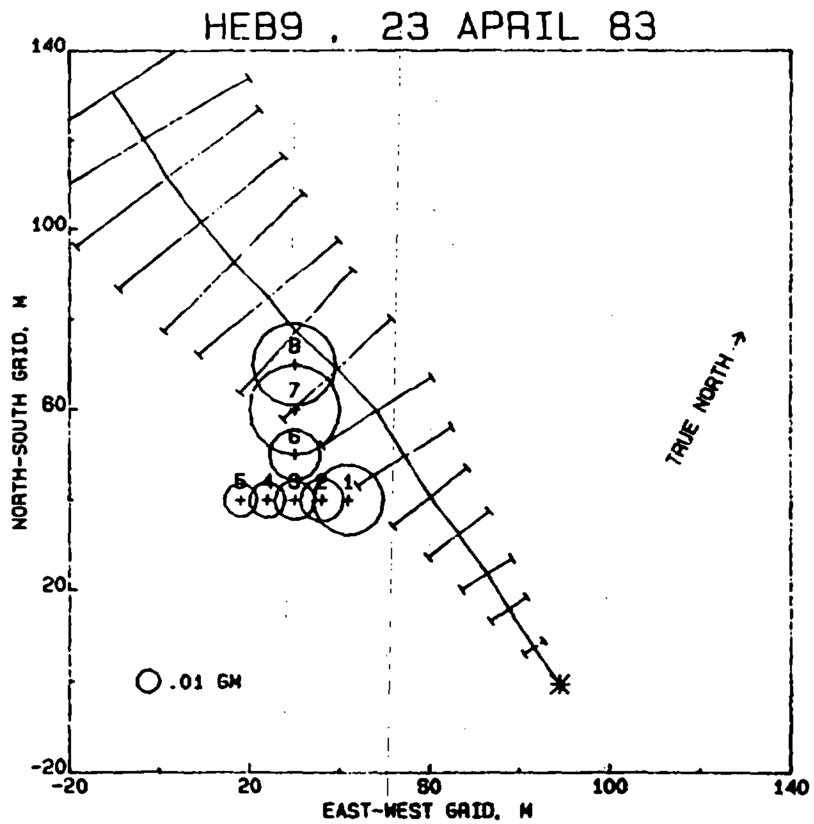
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0858	0.0334	0.0281	0.0221	0.0190	0.0453	0.1429	0.1193

SUM: 0.4959

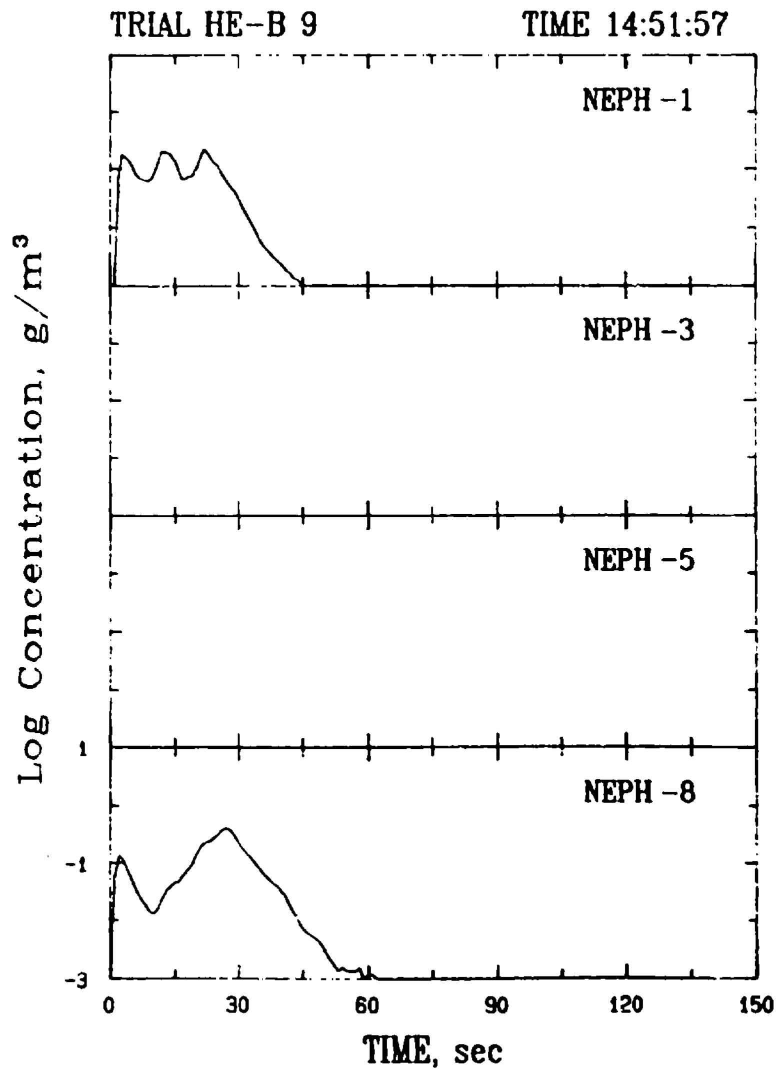
GELMAN DOSAGE (G S/M**3):

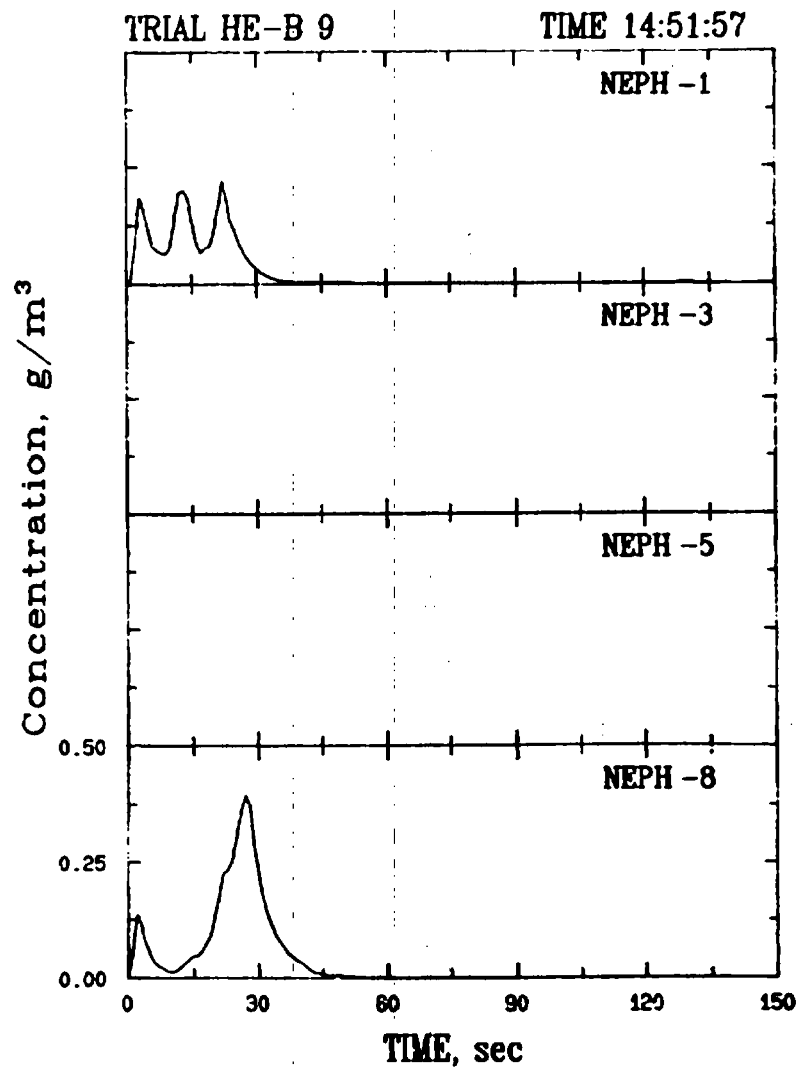
GELMAN A	GELMAN B	GELMAN C	GELMAN D
105.213	42.400	20.174	22.703

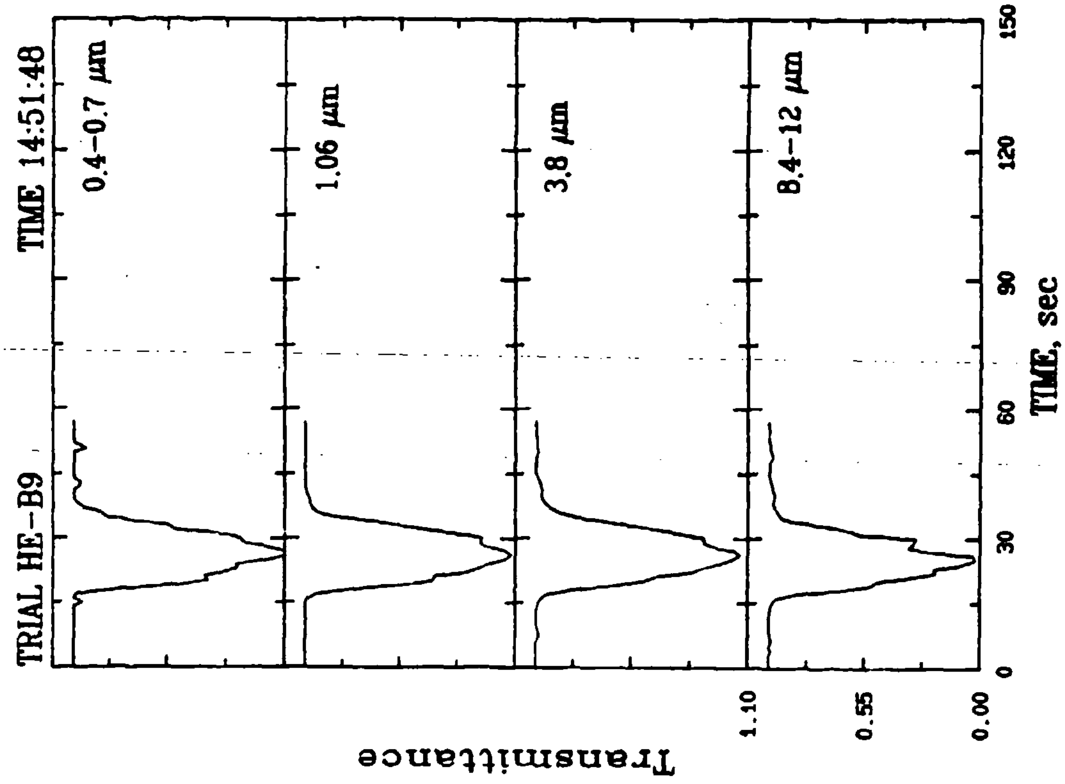




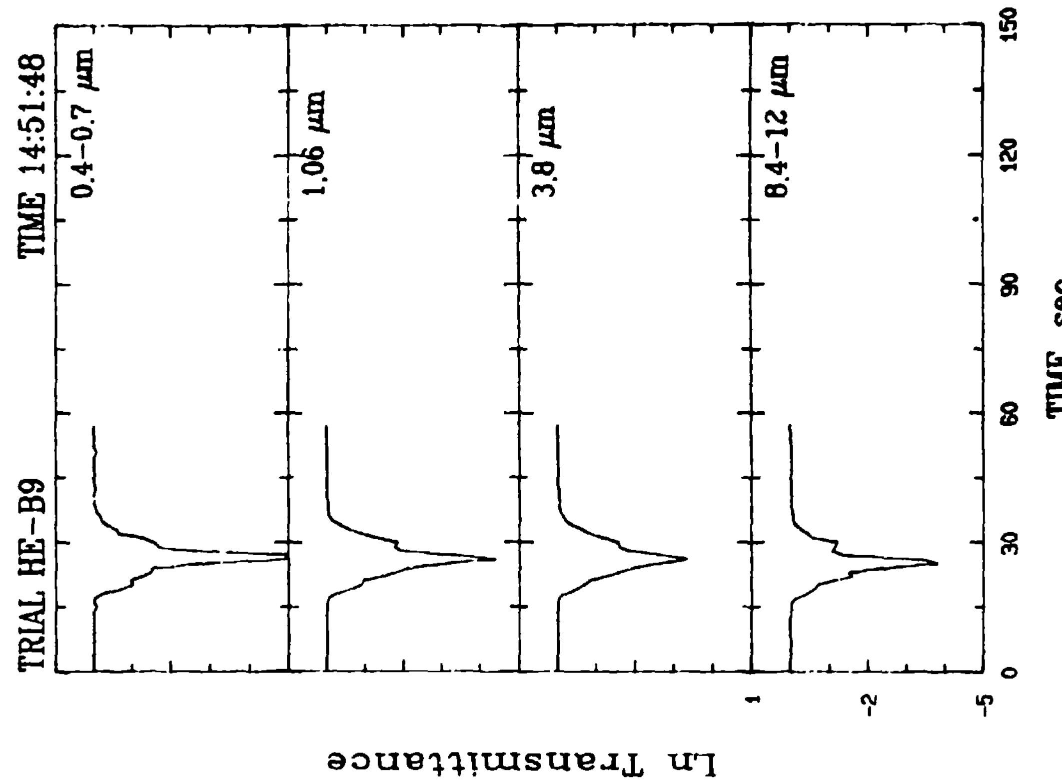
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B 9
TIME 14:51:57
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

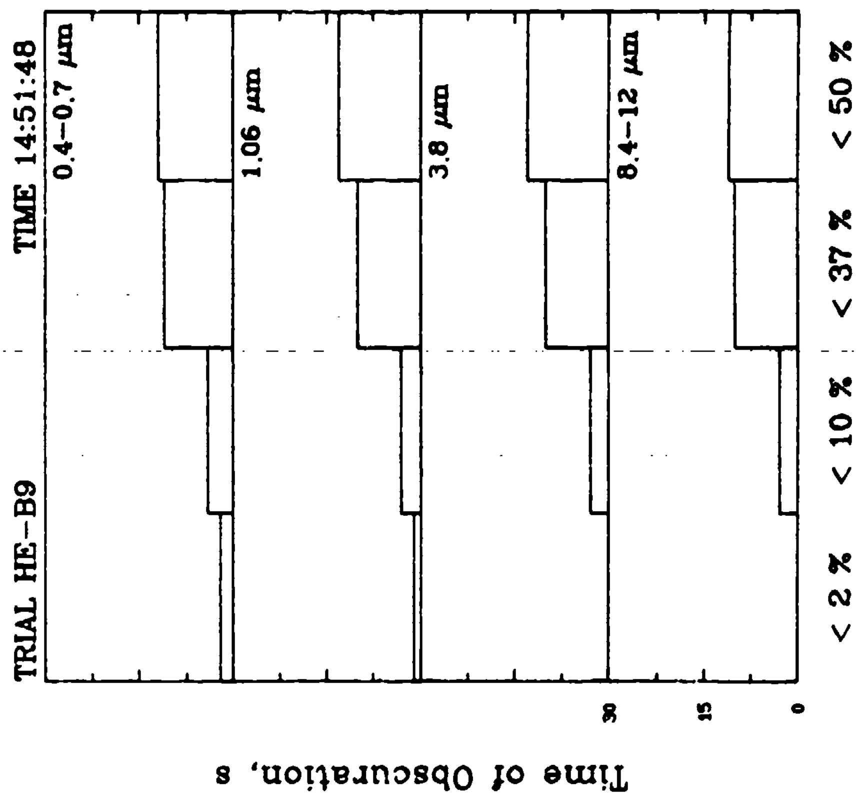

TRIAL HE-B 9
TIME 14:51:57
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.50
0.25
0.00
0
30
60
90
120
150
TIME, sec

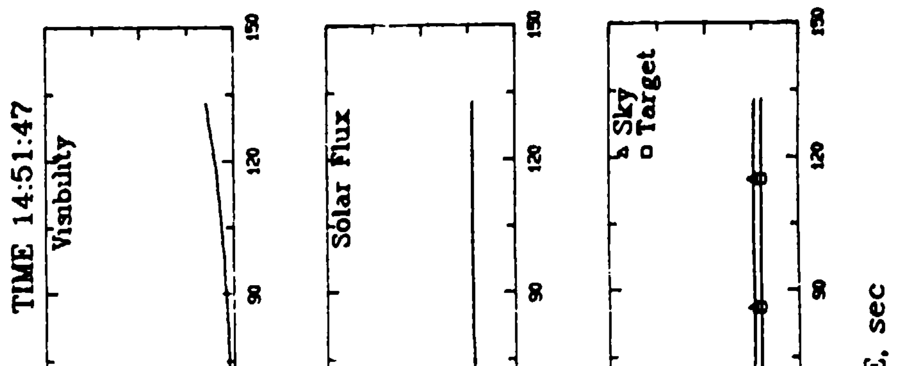


TRIAL HE-B9
TIME 14:51:48
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B9
TIME 14:51:48
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B9
TIME 14:51:48
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
< 2 %
< 10 %
< 37 %
< 50 %
30
15
0
Time of Obscuration, s


TRIAL HE-B9
TIME 14:51:47
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB10

Date: 26 APRIL 83
Detonation Coordinates (M):
X: 43.5
Y: 17.8

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 09:22:04

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -1.620

16 Meter Tower (Means)
Start Time: 9:20:37 End Time: 9:24: 5

	2M	4M	6M	16M
Wind Speed (M/S)	5.61	5.87	6.25	6.74
Wind Dir. (DEG)	116.6	117.2	118.4	118.8
Sigma WSP	1.36	1.44	1.63	1.67
Sigma WDIR	11.9	12.5	12.0	8.7
UVW Components				
U (N-S) (M/S)	2.35	2.52	2.78	3.12
V (E-W) (M/S)	-4.98	-5.16	-5.46	-5.89
W (Vert) (M/S)	0.36	0.41	0.38	*
Sigma U	0.80	0.97	0.91	0.83
Sigma V	1.55	1.63	1.84	1.74
Sigma W	0.17	0.24	0.29	*
Temperature (C)	11.5	10.6	10.3	10.0

Soil Temperature (C): 17.6

Dew Point (C): -0.3

Temperature (C): 10.4

Rel. Hum. (%): 47.1

Abs. Hum. (G/M**3): 4.56

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 586.7

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.10
Target: 0.89

Sky-Target Contrast: -0.19

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	43.0	18.0	75	230	325	515
Post-Shot	43.0	18.0	50	185	190	130

CRATER DATA

Moisture Content: 12.4

CRATER VOLUMES (M**3):
True Crater: 0.875
Apparent Crater: 0.191
Flow: 0.683

DENSITIES (G/CM**3):
Pre-Shot: 1.370
Flow: 1.160
Bottom: 1.122
Side: 1.148

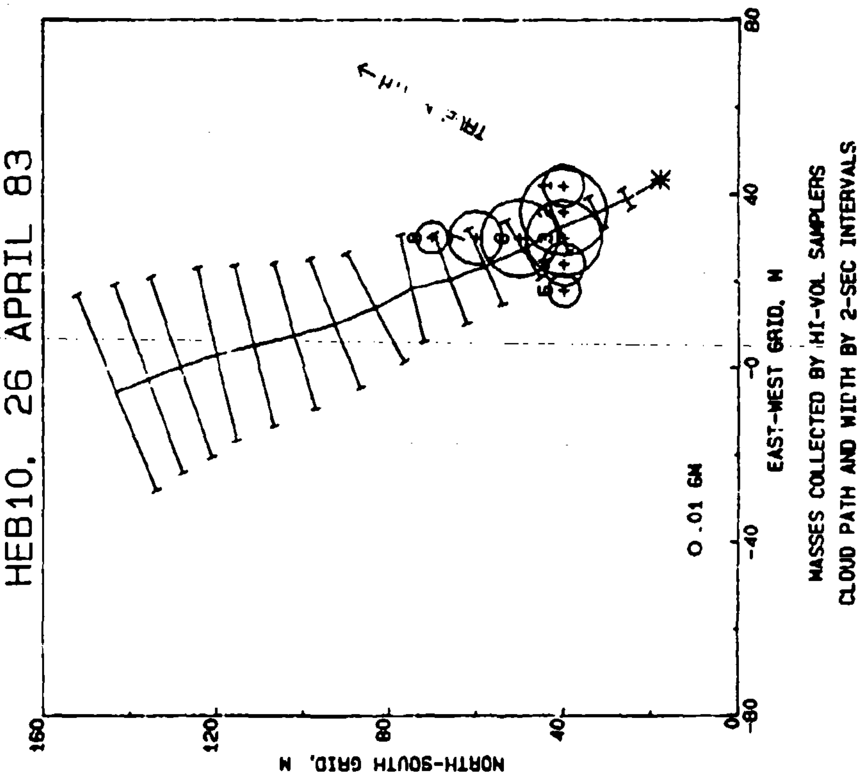
HI VOL DATA (G):

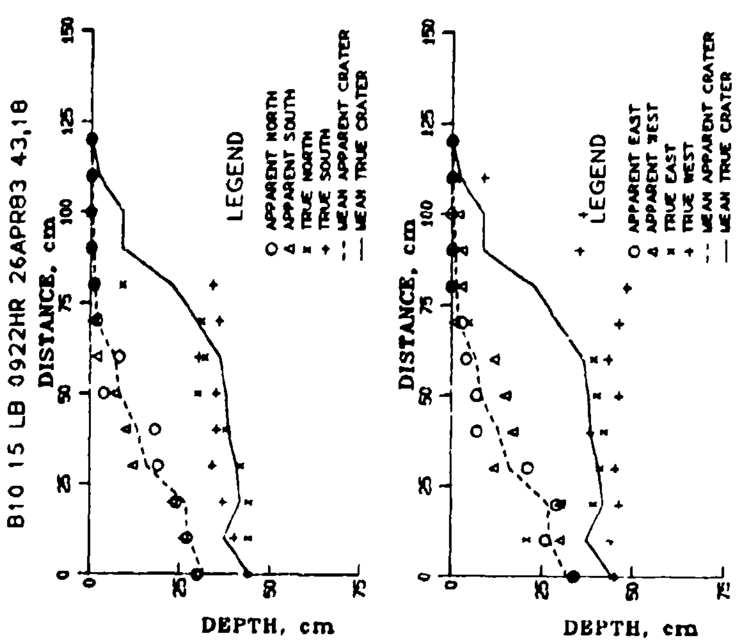
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.1007	0.4363	0.3390	0.1051	0.0582	0.3429	0.1682	0.0593

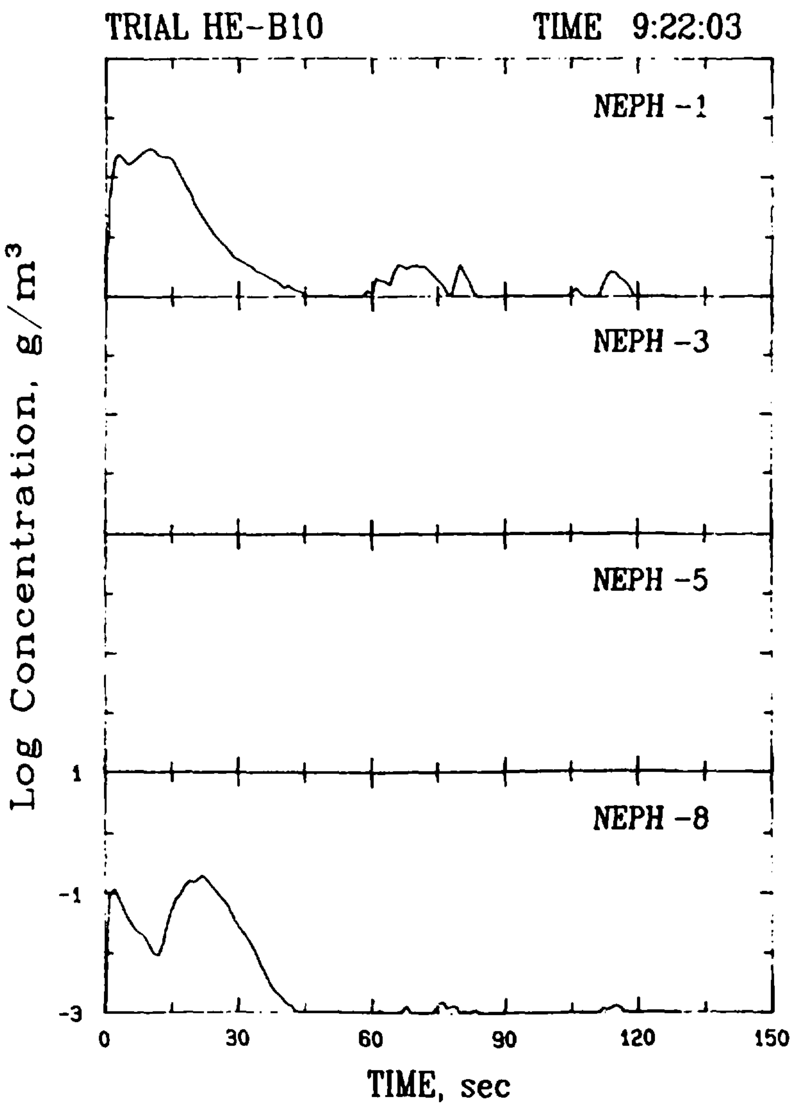
SUM: 1.6097

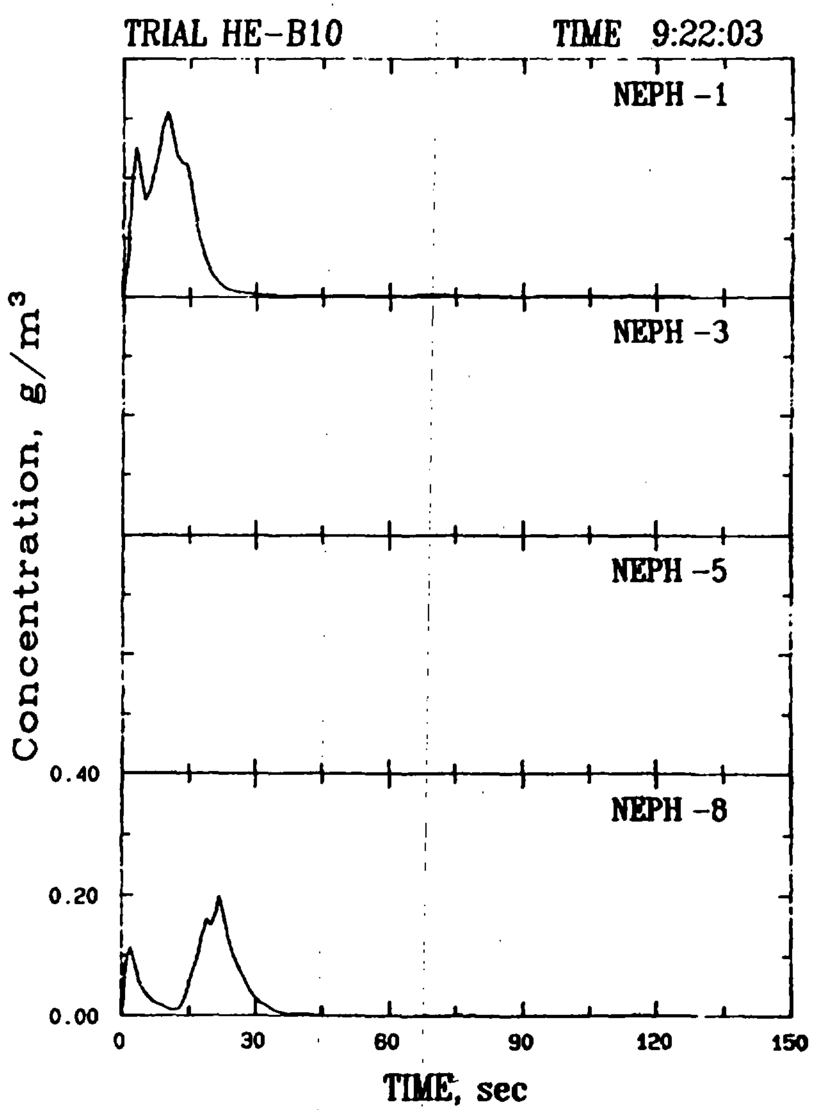
GELMAN DOSAGE (G S/M**3):

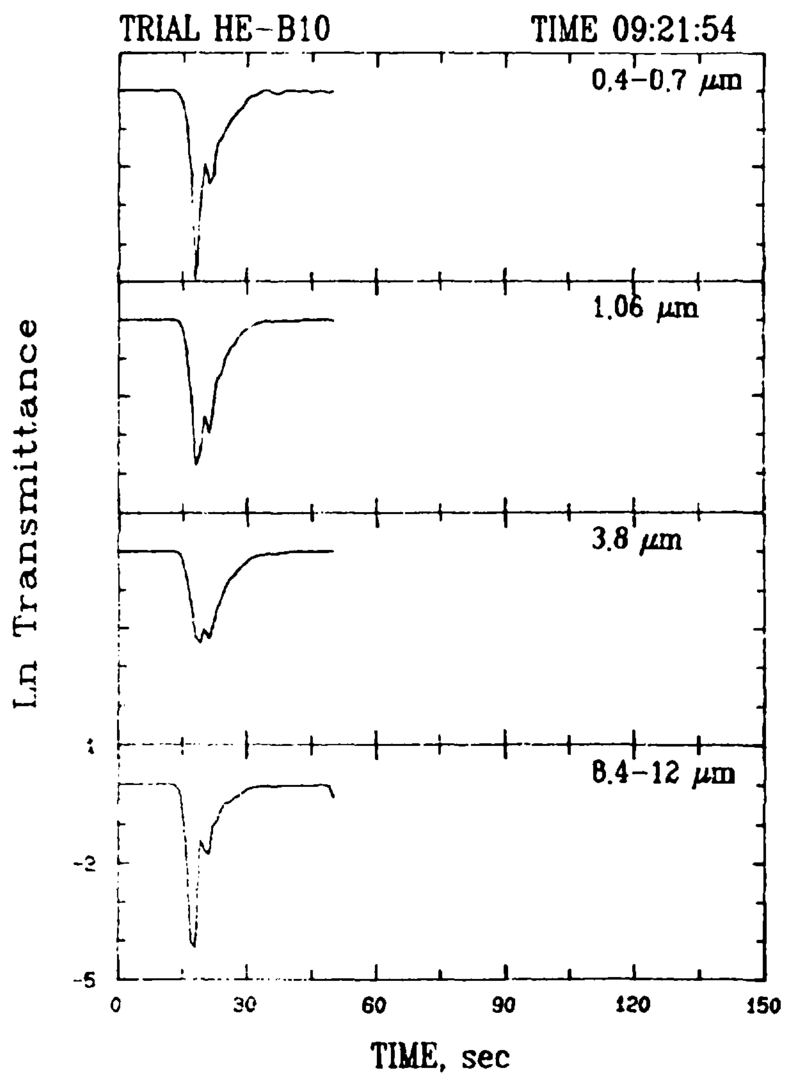
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

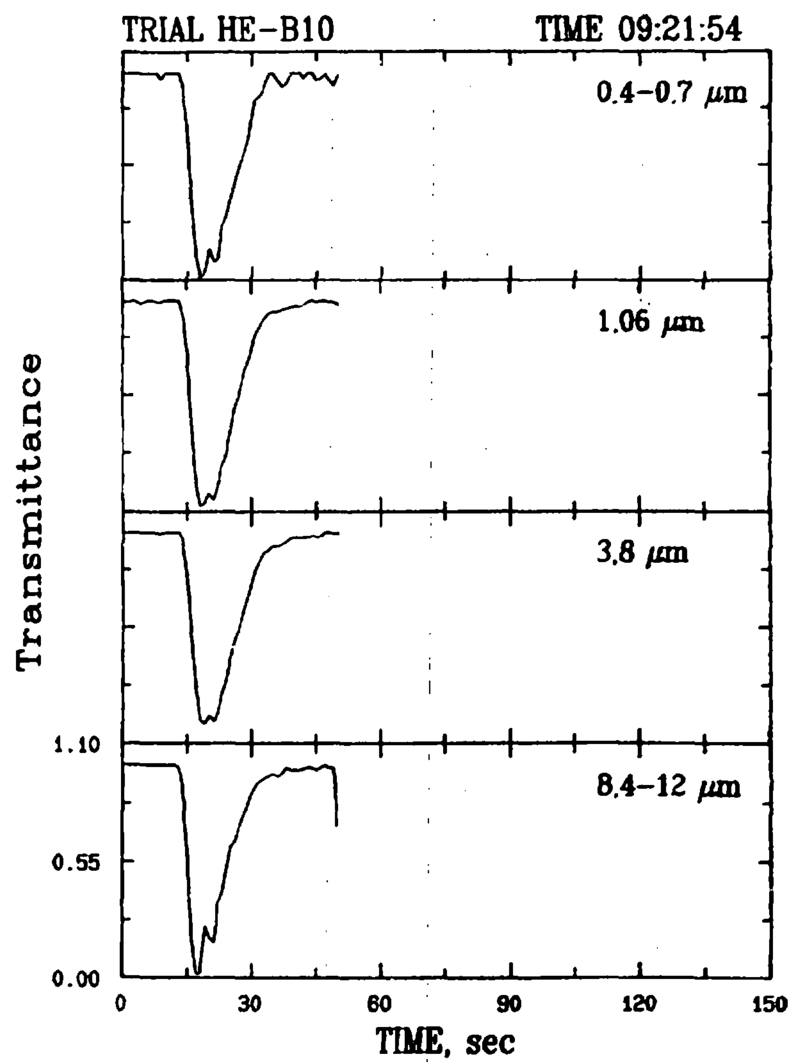

HEB10, 26 APRIL 83
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
O .01 GM
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

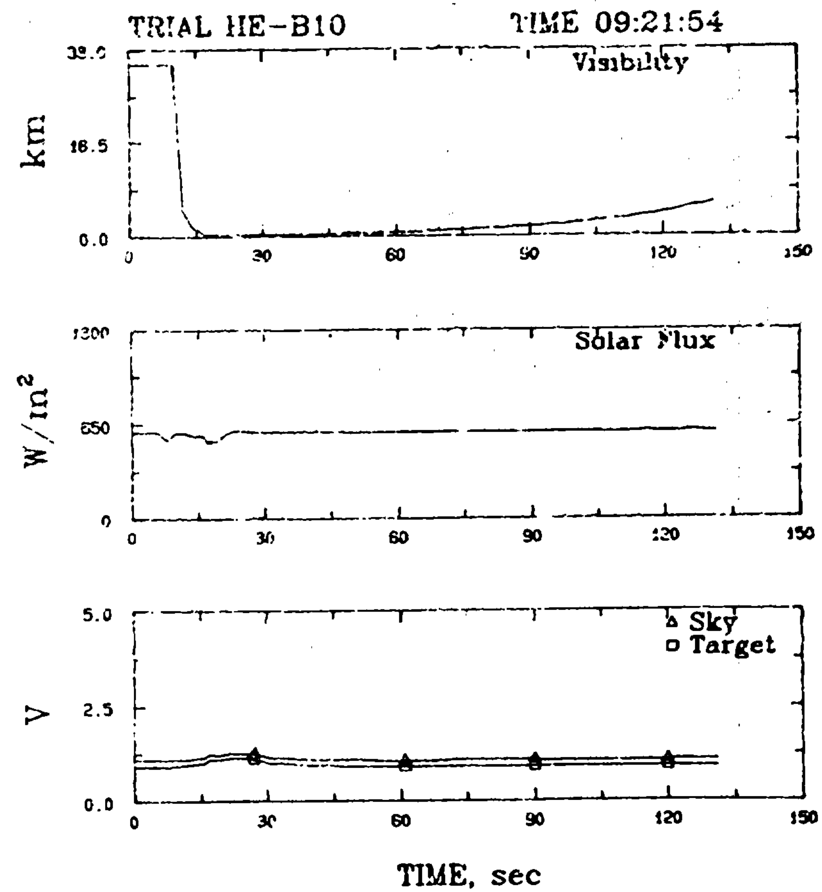

B10 15 LB 0922HR 26APR83 43,18
DISTANCE, cm
DEPTH, cm
LEGEND
O APPARENT NORTH
Δ APPARENT SOUTH
x TRUE NORTH
+ TRUE SOUTH
-- MEAN APPARENT CRATER
— MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
O APPARENT EAST
Δ APPARENT WEST
x TRUE EAST
+ TRUE WEST
-- MEAN APPARENT CRATER
— MEAN TRUE CRATER


TRIAL HE-B10
TIME 9:22:03
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B10
TIME 9:22:03
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.40
0.20
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B10
TIME 09:21:54
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B10
TIME 09:21:54
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B10
TIME 09:21:54
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB11 — Surface Tangent

Date: 26 APRIL 83 — Charge Shape: BLOCK

Detonation Coordinates (M):
X: 39.1
Y: 9.4

Charge Wt: 15.0 LB
Event Time: 10:07:56

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.200

16 Meter Tower (Means)
Start Time: 10: 3:41 End Time: 10: 9:55

	2M	4M	6M	16M
Wind Speed (M/S)	5.11	5.47	5.71	6.46
Wind Dir. (DEG)	135.6	135.2	135.6	136.1
Sigma WSP	1.19	1.29	1.33	1.35
Sigma WDIR	15.1	14.9	14.0	13.2
UVW Components				
U (N-S) (M/S)	3.53	3.80	4.00	4.64
V (E-W) (M/S)	-3.43	-3.67	-3.83	-4.24
W (Vert) (M/S)	0.3?	0.44	0.28	*
Sigma U	1.31	1.48	1.50	1.77
Sigma V	1.26	1.23	1.24	0.94
Sigma W	0.27	0.30	0.33	*
Temperature (C)	12.5	11.5	11.1	10.5

Soil Temperature (C): 21.4 — Solar Flux (W/M**2): 726.1

Dew Point (C): 0.3 — Visual Range (M): 30480.0

Temperature (C): 11.5 — Vista Ranger Voltages: Sky: 1.23, Target: 0.98

Rel. Hum. (%): 46.0

Abs. Hum. (G/M**3): 4.76 — Sky-Target Contrast: -0.20

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	39.0	9.0	40	155	175	285
Post-Shot	39.0	9.0	40	120	310	700

CRATER DATA

Moisture Content: 11.8

CRATER VOLUMES (M**3):
True Crater: 0.547
Apparent Crater: 0.143
Flow: 0.404

DENSITIES (G/CM**3):
Pre-Shot: 1.34
Flow: 1.005
Bottom: 1.165
Side: 0.845

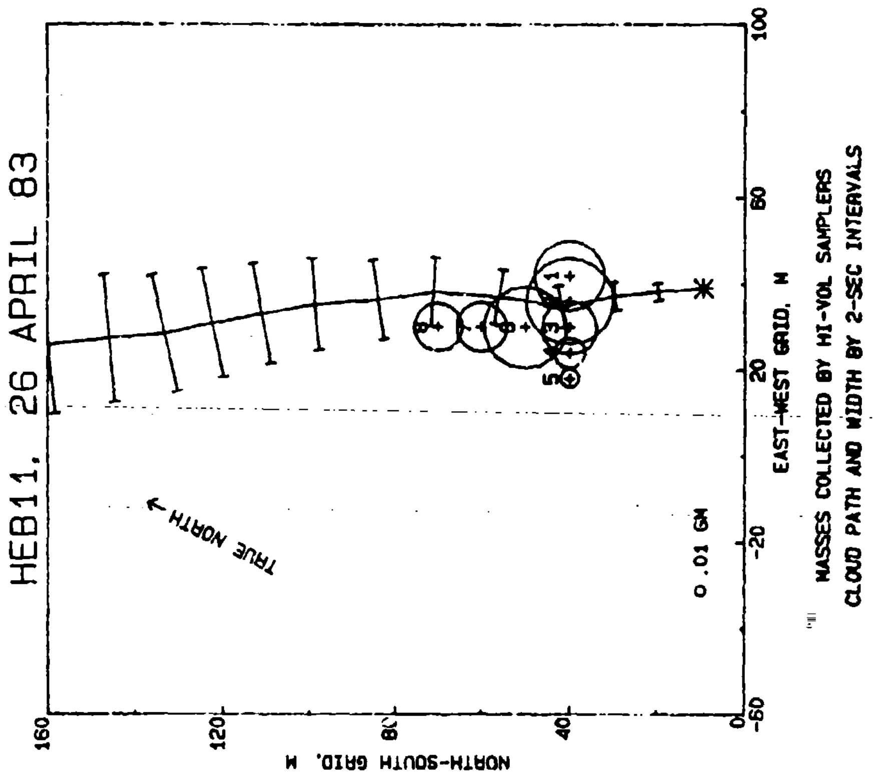
HI VOL DATA (G):

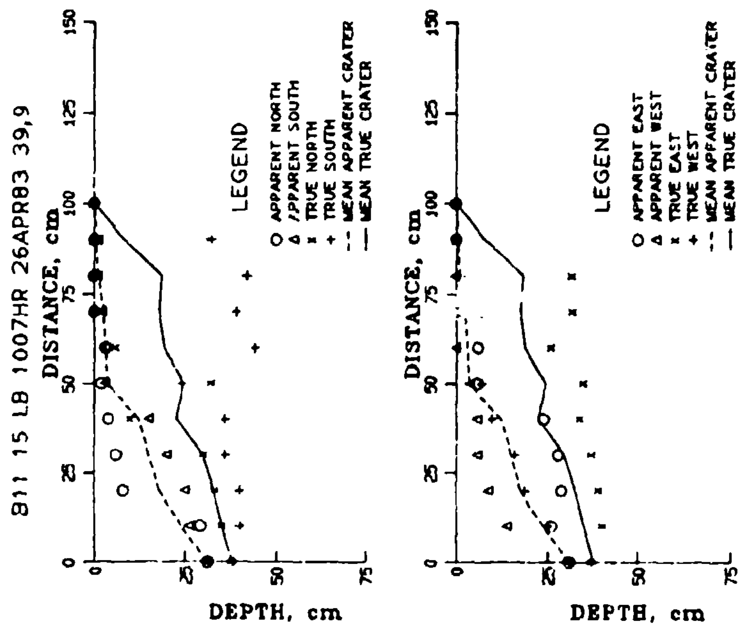
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.3915	0.6033	0.2360	0.0761	0.0306	0.5330	0.1969	0.1908

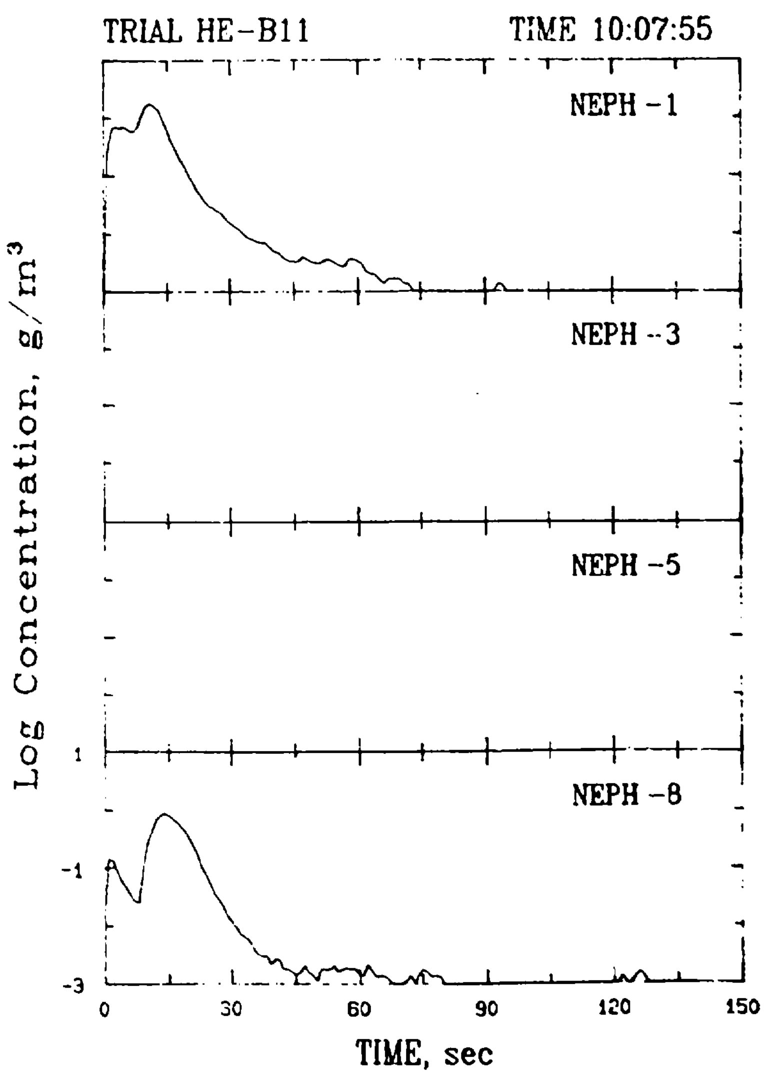
SUM: 2.2582

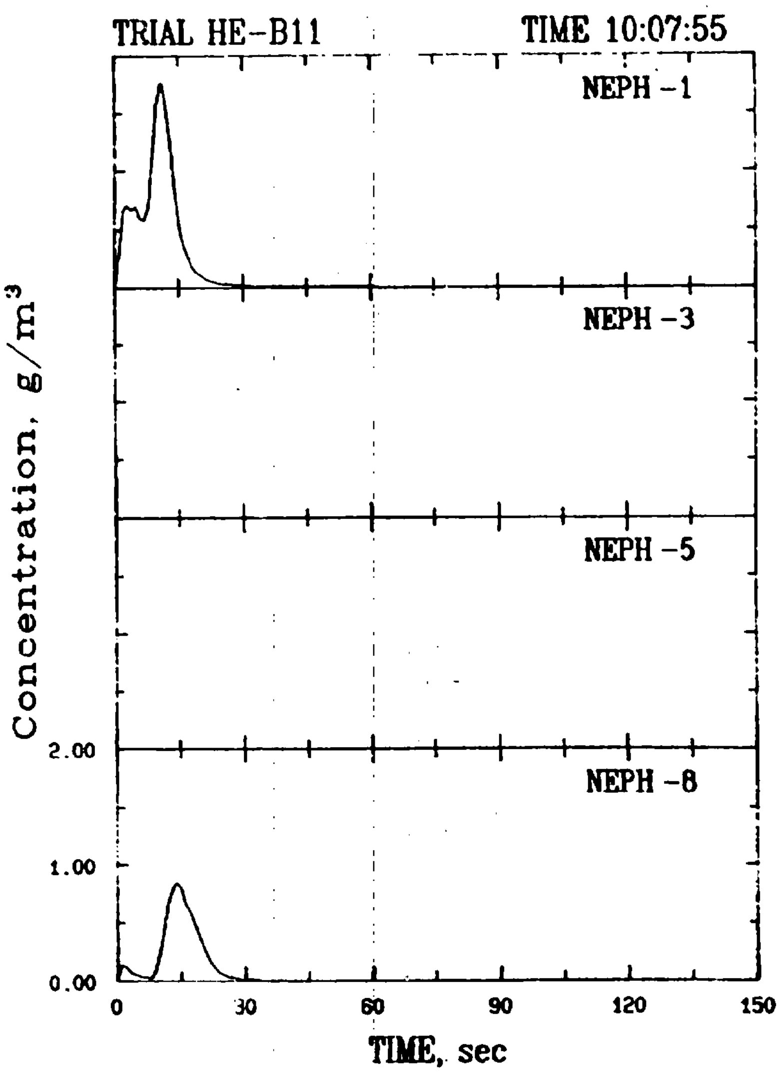
GELMAN DOSAGE (G S/M**3):

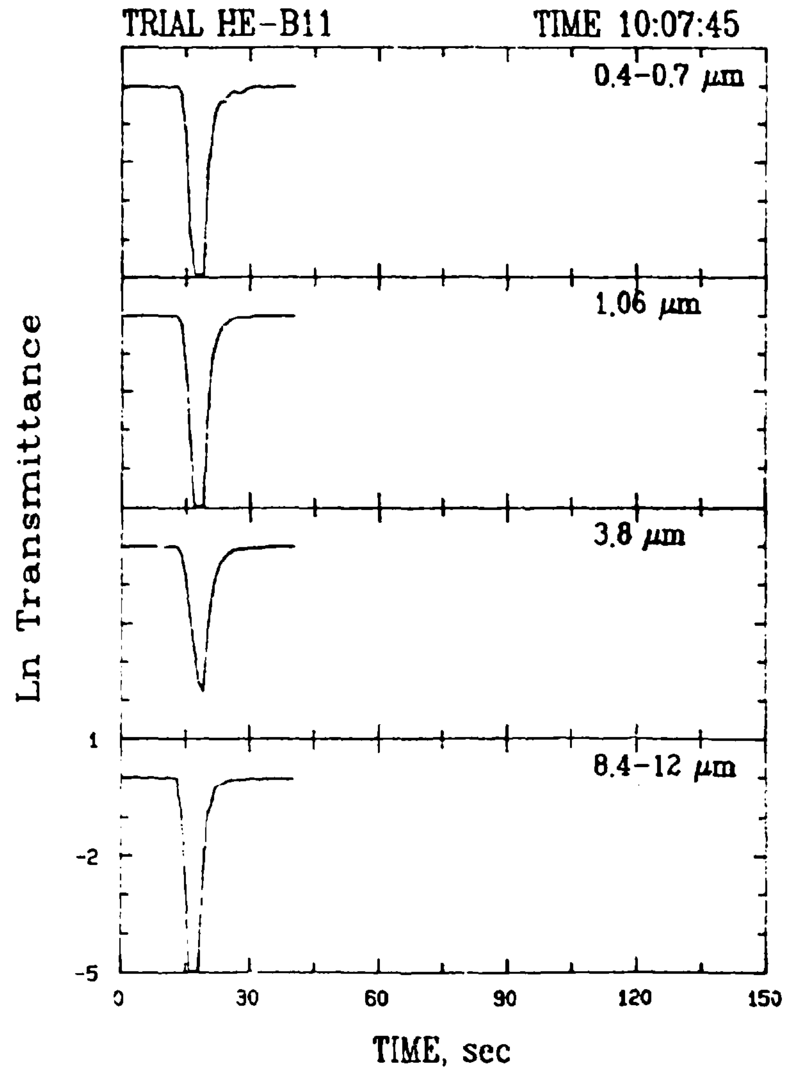
GELMAN A	GELMAN B	GELMAN C	GELMAN D
2.844	48.800	53.051	62.703

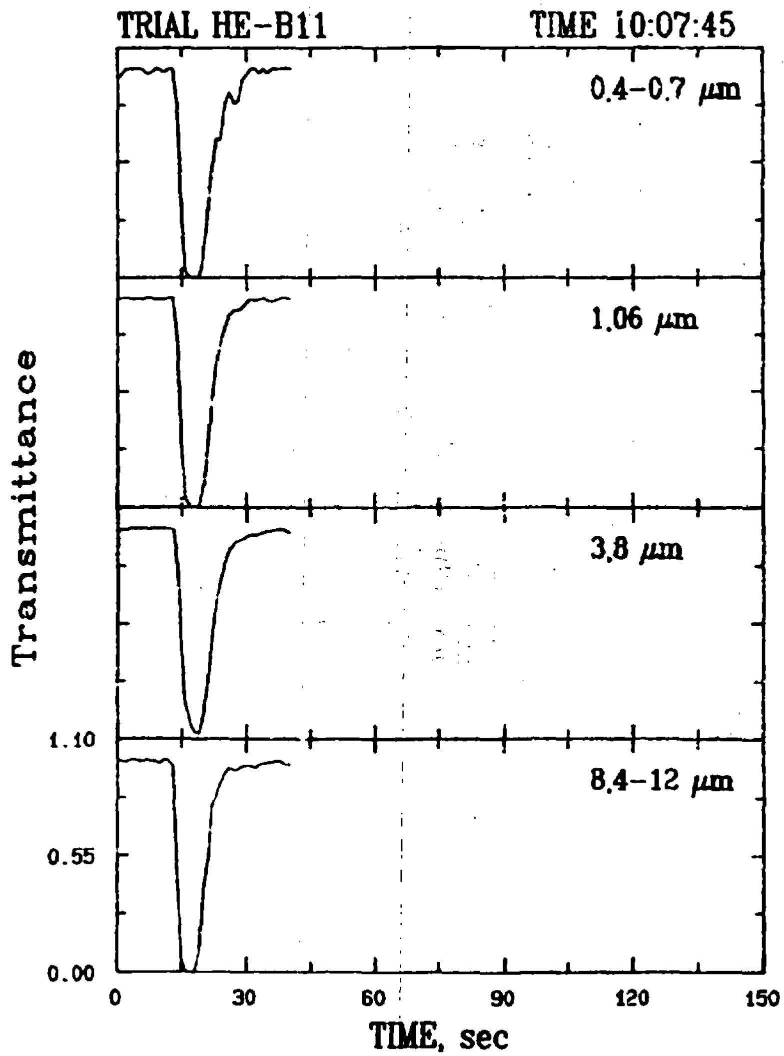

HEB11, 26 APRIL 83
TRUE NORTH
0.01 GM
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

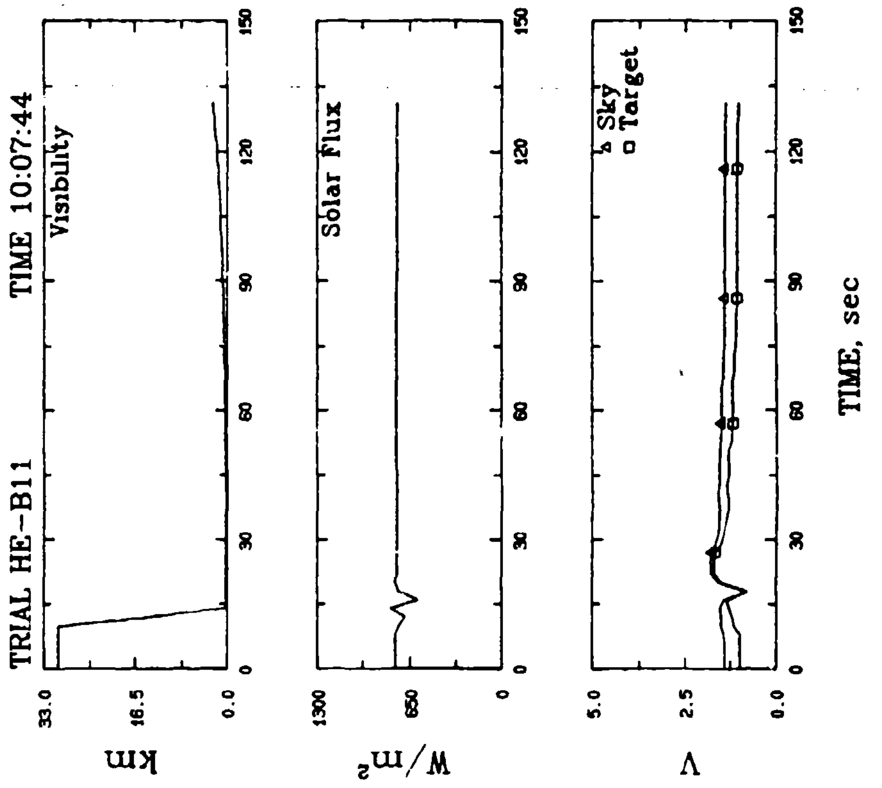

811 15 LB 1007HR 26APR83 39,9
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT NORTH
APPARENT SOUTH
TRUE NORTH
TRUE SOUTH
MEAN APPARENT CRATER
MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT EAST
APPARENT WEST
TRUE EAST
TRUE WEST
MEAN APPARENT CRATER
MEAN TRUE CRATER


TRIAL HE-B11
TIME 10:07:55
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B11
TIME 10:07:55
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
2.00
1.00
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B11
TIME 10:07:45
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B11
TIME 10:07:45
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B11
TIME 10:07:44
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB12

Date: 26 APRIL 83
Detonation Coordinates (M):
X: 65.0
Y: -11.4

Surface Tangent Buried

Charge Shape: BLOCK

Charge Wt: 15.0 LB
Event Time: 11:22:38

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.468

16 Meter Tower (Means)
Start Time: 11:20: 3   End Time: 11:24:37

	2M	4M	6M	16M
Wind Speed (M/S)	4.37	4.57	4.92	5.52
Wind Dir. (DEG)	131.1	131.7	132.5	136.2
Sigma WSP	1.38	1.40	1.48	1.66
Sigma WDIR	18.8	17.4	16.8	17.7
UVW Components				
U (N-S) (M/S)	2.73	2.94	3.19	3.79
V (E-W) (M/S)	-3.09	-3.21	-3.44	-3.63
W (Vert) (M/S)	0.25	0.29	0.17	*
Sigma U	1.42	1.49	1.51	1.74
Sigma V	1.40	1.30	1.44	1.64
Sigma W	0.27	0.33	0.33	*
Temperature (C)	14.0	13.0	12.6	12.2

Soil Temperature (C): 27.5

Dew Point (C): 0.2

Temperature (C): 12.8

Rel. Hum. (%): 42.0

Abs. Hum. (G/M**3): 4.73

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 933.3

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.75
Target: 1.07

Sky-Target Contrast: -0.39

CONE INDEX:

	X,Y Coord (M)	SPC	15	30	45
Pre-Shot	65.0 -11.0	125	265	635	750+
Post-Shot	65.0 -11.0	40	220	500	590

CRATER DATA

Moisture Content: 12.1

CRATER VOLUMES (M**3):
True Crater: 1.674
Apparent Crater: 0.779
Flow: 0.896

DENSITIES (G/CM**3):
Pre-Shot: 1.28
Flow: 1.206
Bottom: 1.308
Side: 1.104

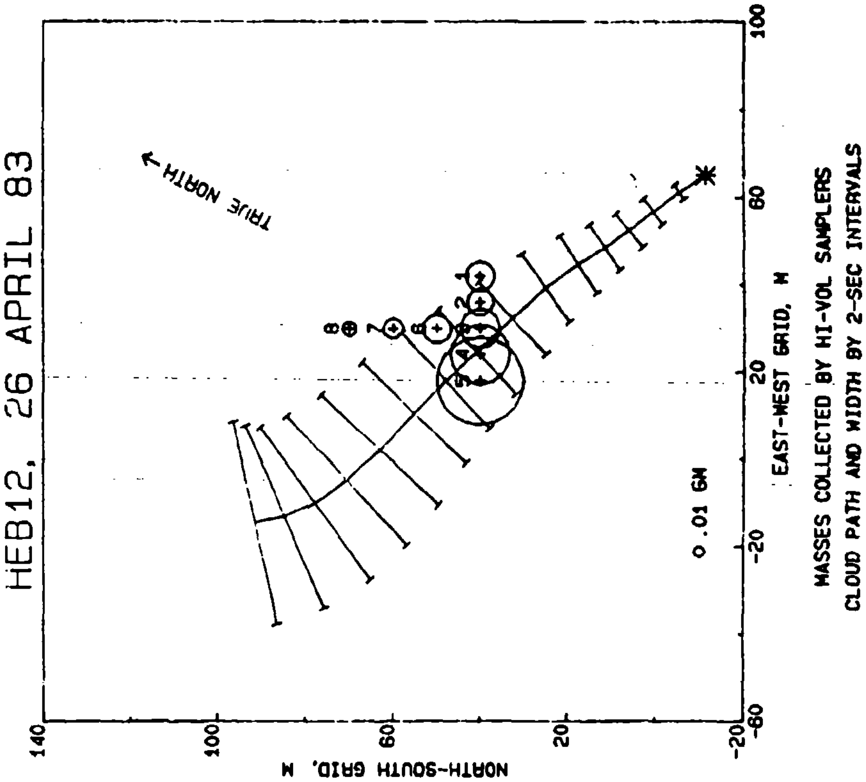
HI VOL DATA (G):

HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0635	0.0557	0.1270	0.2827	0.6118	0.0638	0.0325	0.0154

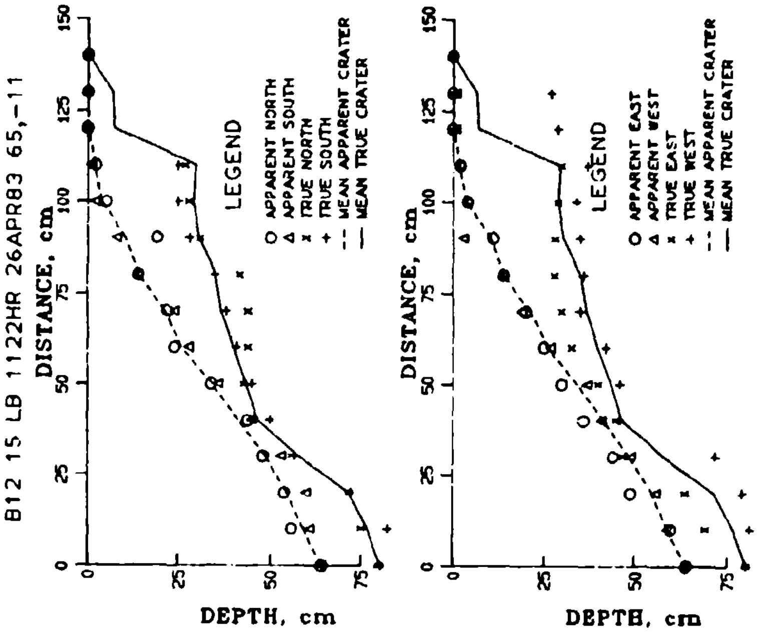
SUM: 1.2524

GELMAN DOSAGE (G S/M**3):

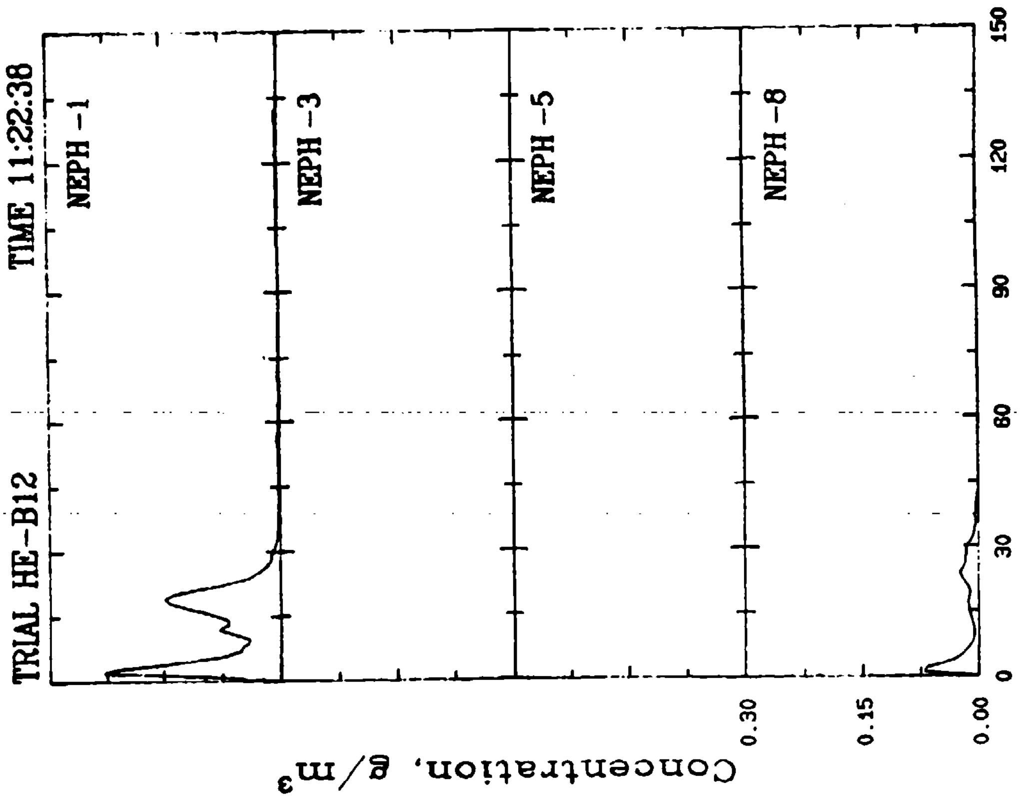
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

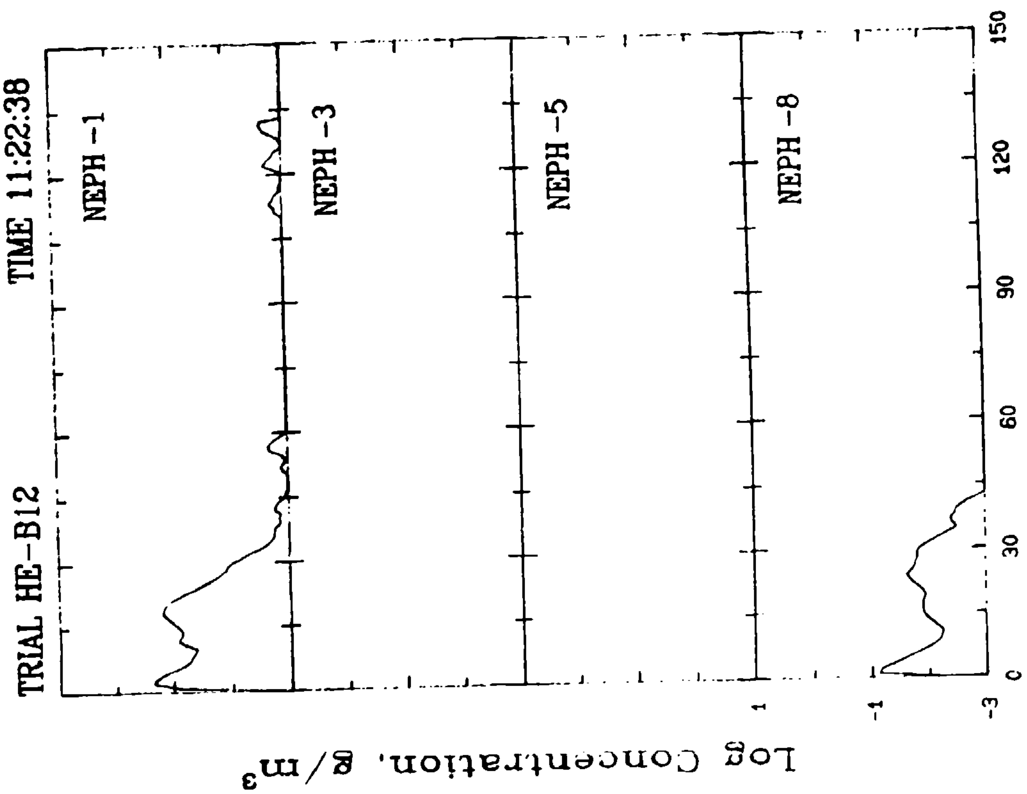


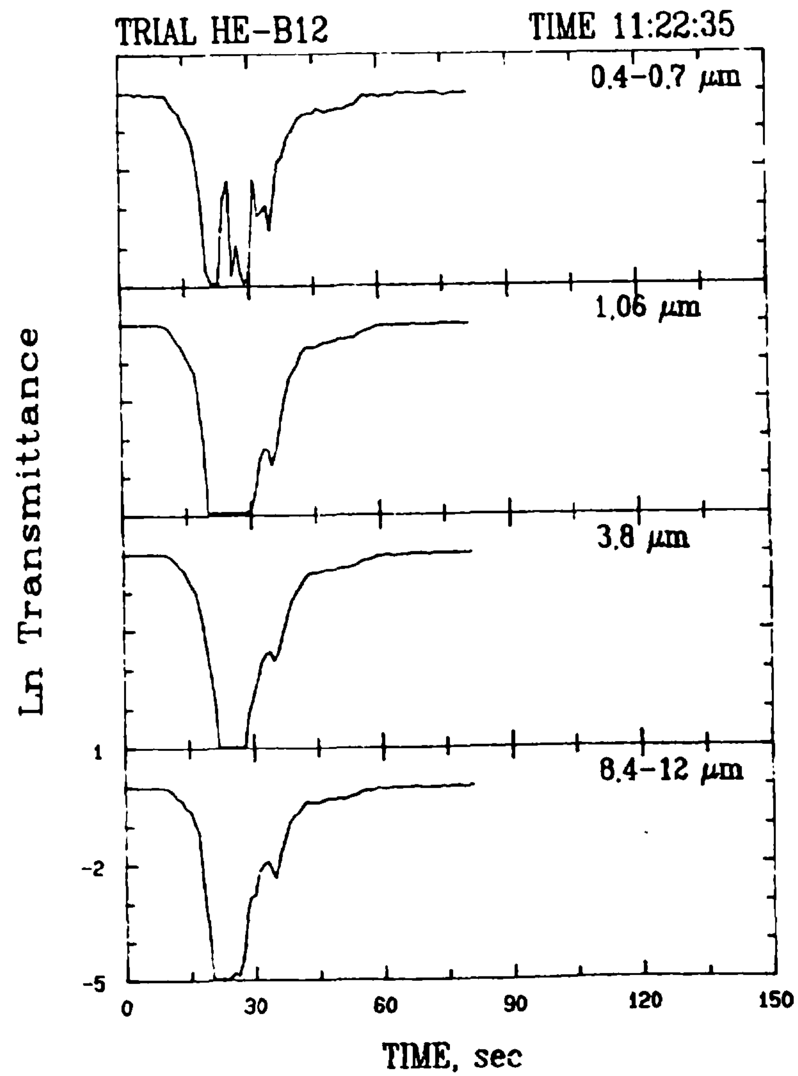
HEB12, 26 APRIL 83
TRUE NORTH
NORTH-SOUTH GRID, M
EAST-WEST GRID, M
o .01 GM
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

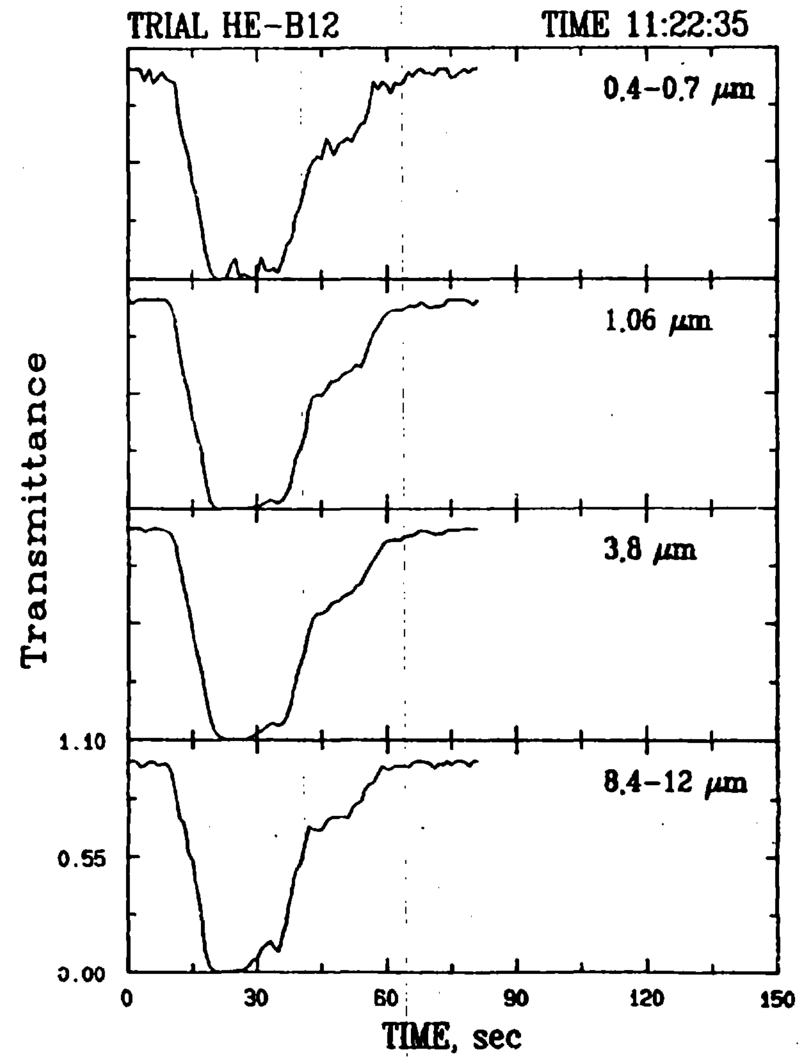


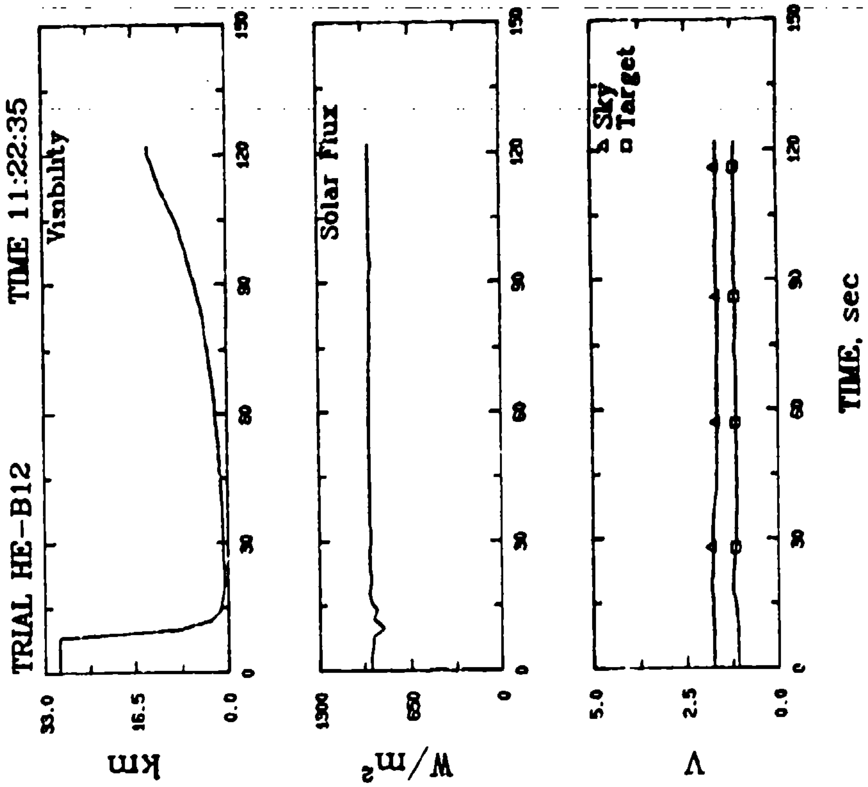
B12 15 LB 1122HR 26APR83 65,-11
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT NORTH
APPARENT SOUTH
TRUE NORTH
TRUE SOUTH
MEAN APPARENT CRATER
MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT EAST
APPARENT WEST
TRUE EAST
TRUE WEST
MEAN APPARENT CRATER
MEAN TRUE CRATER


TRIAL HE-B12
TIME 11:22:38
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.30
0.15
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B12
TIME 11:22:38
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B12
TIME 11:22:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B12
TIME 11:22:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B12
TIME 11:22:35
Visibility
Solar Flux
Sky
Target
km
W/m²
V
TIME, sec

EVENT SUMMARY DATA

Test Number: SEB13

Surface Tangent Buried

Date: 26 APRIL 83
Detonation Coordinates (M):
X: 51.4
Y: -11.5

Charge Shape: BLOCK

Charge Wt: 15.0 LB
Event Time: 12:25:35

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -1.142

16 Meter Tower (Means)
Start Time: 12:21:59 End Time: 12:27:40

	2M	4M	6M	16M
Wind Speed (M/S)	5.14	5.40	5.77	6.41
Wind Dir. (DEG)	125.2	124.5	125.1	122.1
Sigma WSP	1.39	1.47	1.63	1.77
Sigma WDIR	13.8	13.5	12.6	11.2
UVW Components				
U (N-S) (M/S)	2.79	2.91	3.16	3.30
V (E-W) (M/S)	-4.12	-4.34	-4.63	-5.33
W (Vert) (M/S)	0.32	0.42	0.37	*
Sigma U	1.21	1.37	1.37	1.44
Sigma V	1.45	1.45	1.62	1.69
Sigma W	0.24	0.24	0.29	*
Temperature (C)	15.0	14.1	13.7	13.1

Soil Temperature (C): 24.5

Solar Flux (W/M**2): 791.2

Dew Point (C): 0.9

Visual Range (M): 30480.0

Temperature (C): 14.0

Vista Ranger Voltages:
Sky: 1.74
Target: 0.97

Rel. Hum. (%): 40.9

Abs. Hum. (G/M**3): 4.96

Sky-Target Contrast: -0.44

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	51.0 -11.0	40	215	290	635
Post-Shot	51.0 -11.0	50	110	155	155

CRATER DATA

Moisture Content: 7.2

CRATER VOLUMES (M**3):
True Crater: 2.013
Apparent Crater: 0.440
Flow: 1.573

DENSITIES (G/CM**3):
Pre-Shot: 1.44
Flow: 1.188
Bottom: 1.321
Side: 1.056

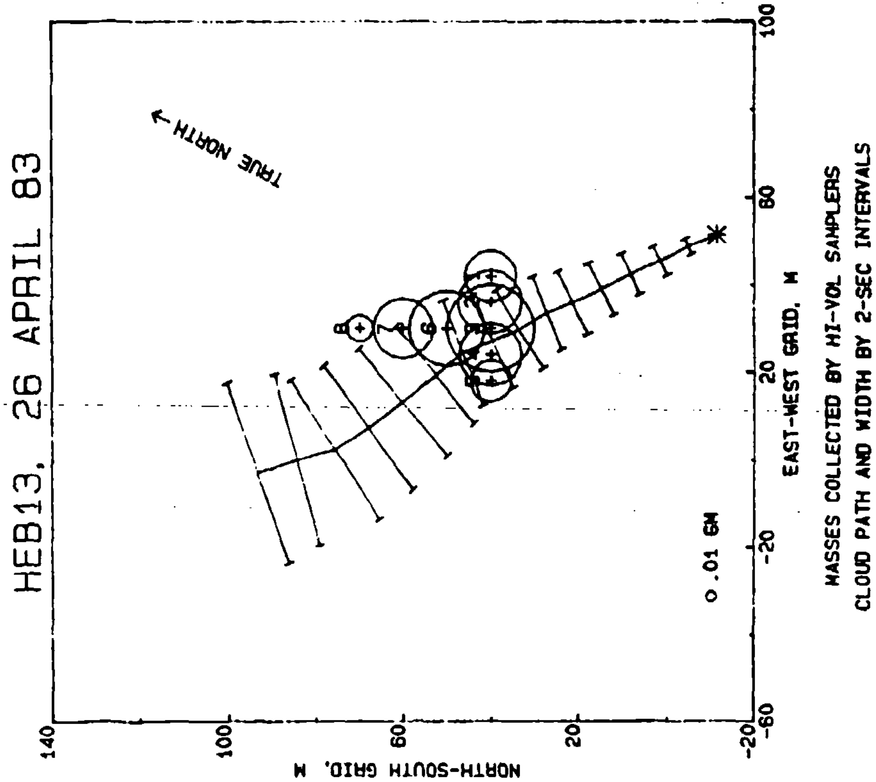
HI VOL DATA (G):

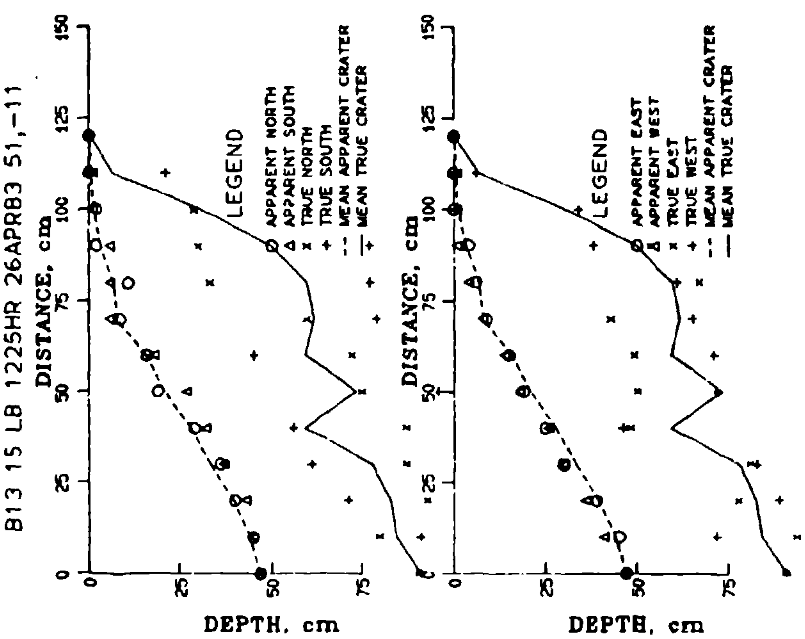
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.2382	0.3612	0.6893	0.3433	0.1490	0.5181	0.3210	0.0676

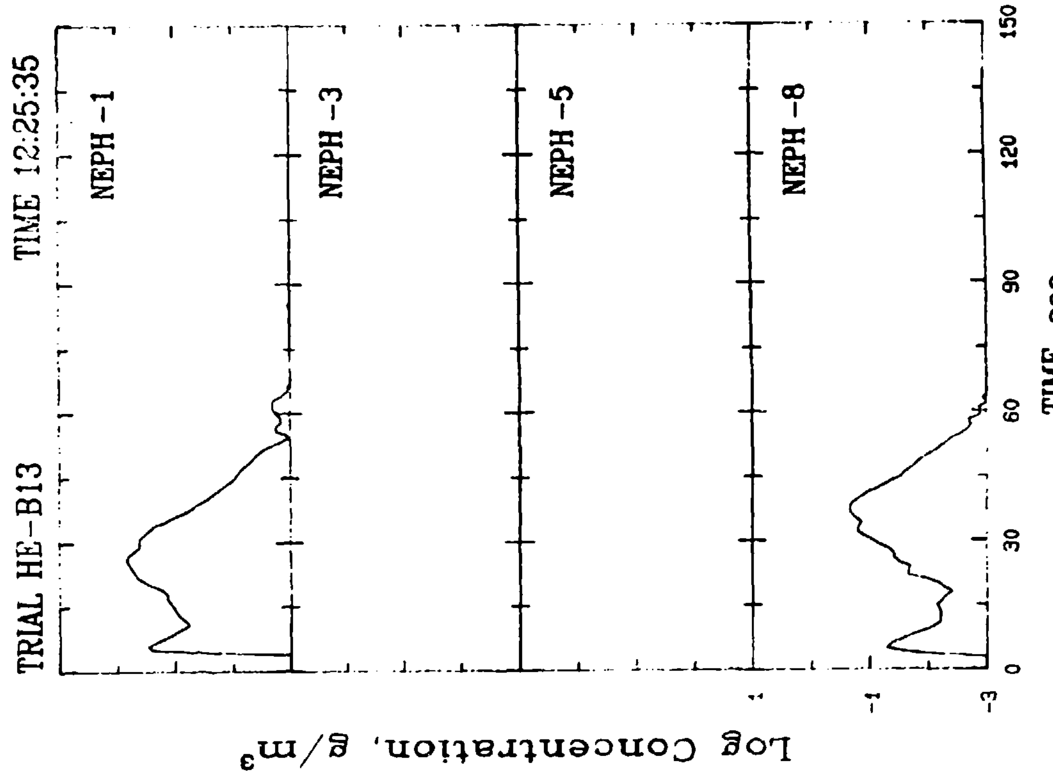
SUM: 2.6877

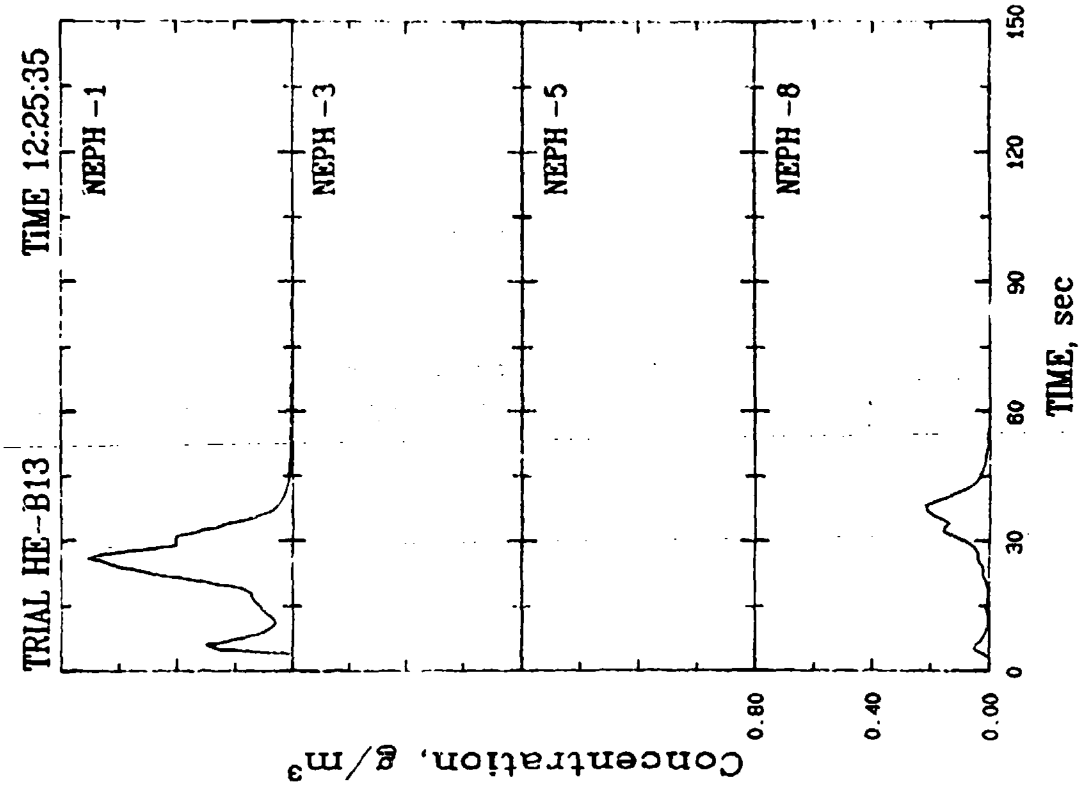
GELMAN DOSAGE (G S/M**3):

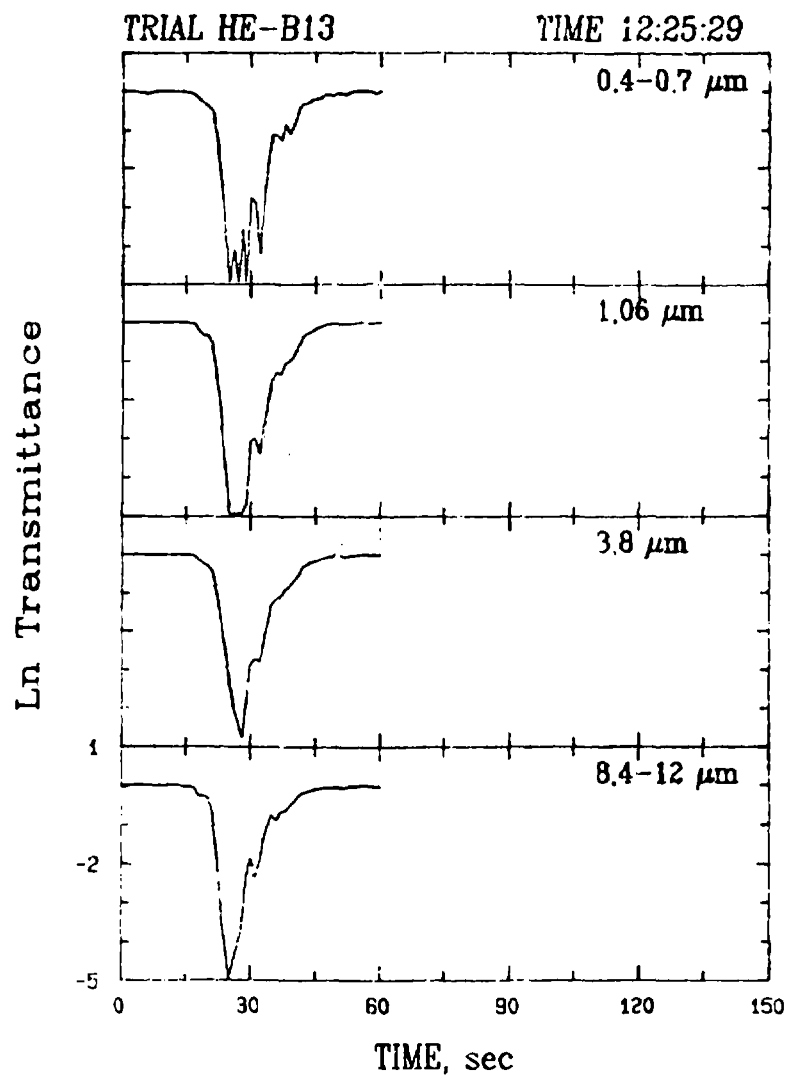
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000


HEB13, 26 APRIL 83
TRUE NORTH
o .01 GM
EAST-WEST GRID, M
NORTH-SOUTH GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

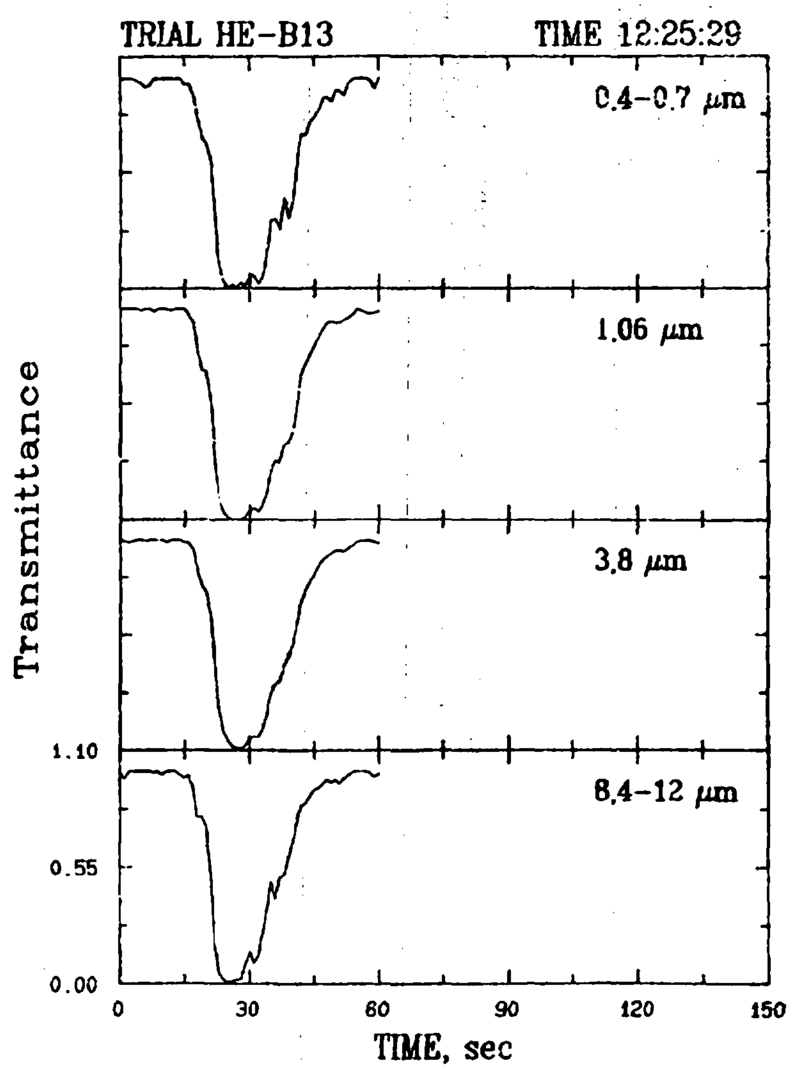

B13 15 LB 1225HR 26APR83 51,-11
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT NORTH
APPARENT SOUTH
TRUE NORTH
TRUE SOUTH
MEAN APPARENT CRATER
MEAN TRUE CRATER
DISTANCE, cm
DEPTH, cm
LEGEND
APPARENT EAST
APPARENT WEST
TRUE EAST
TRUE WEST
MEAN APPARENT CRATER
MEAN TRUE CRATER


TRIAL HE-B13
TIME 12:25:35
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec

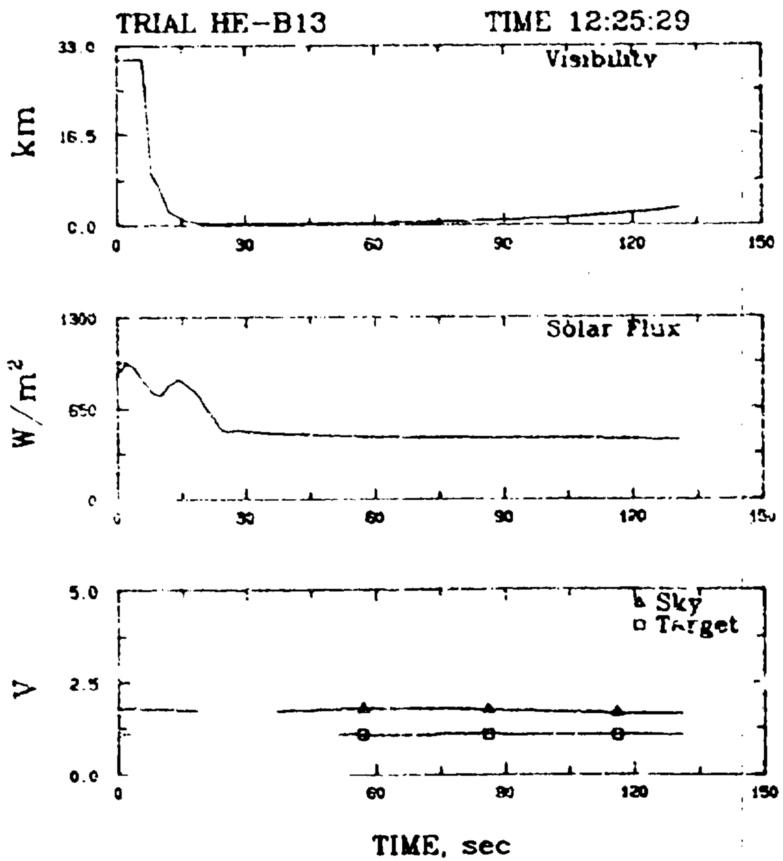

TRIAL HE-B13
TIME 12:25:35
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.80
0.40
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B13
TIME 12:25:29
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B13
TIME 12:25:29
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B13
TIME 12:25:29
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HE814

Date. 26 APRIL 83
Detonation Coordinates (M):
X: 50.5
Y: 9.8

Above Ground

Charge Shape: BLOCK

Charge Wt: 15.0 LB
Event Time: 13:34:01

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -14.845

16 Meter Tower (Means)
Start Time: 13:30:37   End Time. 13:36: 2

	2M	4M	6M	16M
Wind Speed (M/S)	5.67	6.13	6.33	6.92
Wind Dir. (DEG)	146.1	146.3	145.6	147.1
Sigma WSP	2.02	2.24	2.12	2.39
Sigma WDIR	18.1	16.9	17.3	16.0
UVW Components				
U (N-S) (M/S)	4.62	5.04	5.17	5.85
V (E-W) (M/S)	-2.81	-3.03	-3.16	-3.31
W (Vert) (M/S)	0.21	0.32	0.01	*
Sigma U	2.23	2.48	2.46	2.71
Sigma V	1.42	1.37	1.33	1.08
Sigma W	0.31	0.49	0.30	*
Temperature (C)	16.0	15.1	14.5	14.2

Soil Temperature (C): 32.2

Dew Point (C): -0.7

Temperature (C): 15.1

Rel. Hum. (%): 33.8

Abs. Hum. (G/M**3): 4.37

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 1003.2

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.93
Target: 1.22

Sky-Target Contrast: -0.37

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	60.0	10.0	25	175	265	430
Post-Shot	60.0	10.0	90	315	265	275

CRATER DATA

Moisture Content: *

CRATER VOLUMES (M**3):
True Crater: *
Apparent Crater: *
Flow: *

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: *
Bottom: *
Side: *

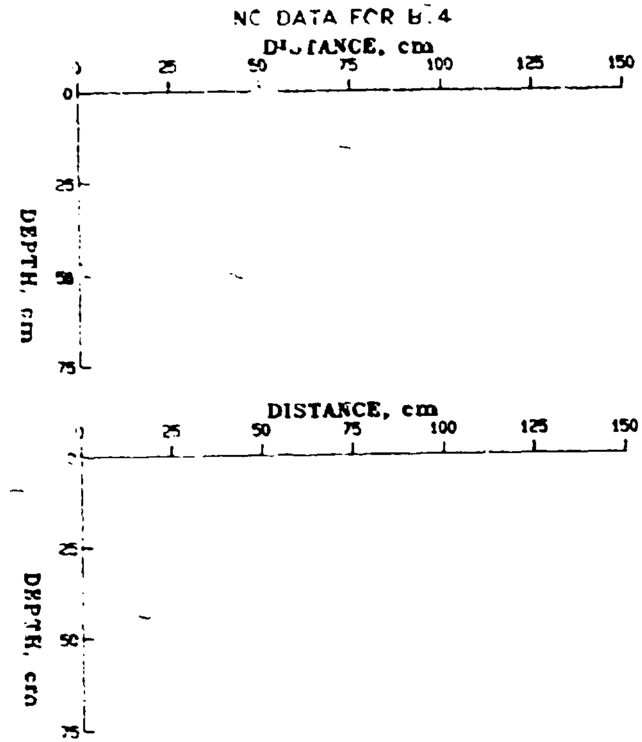
HI VOL DATA (G):

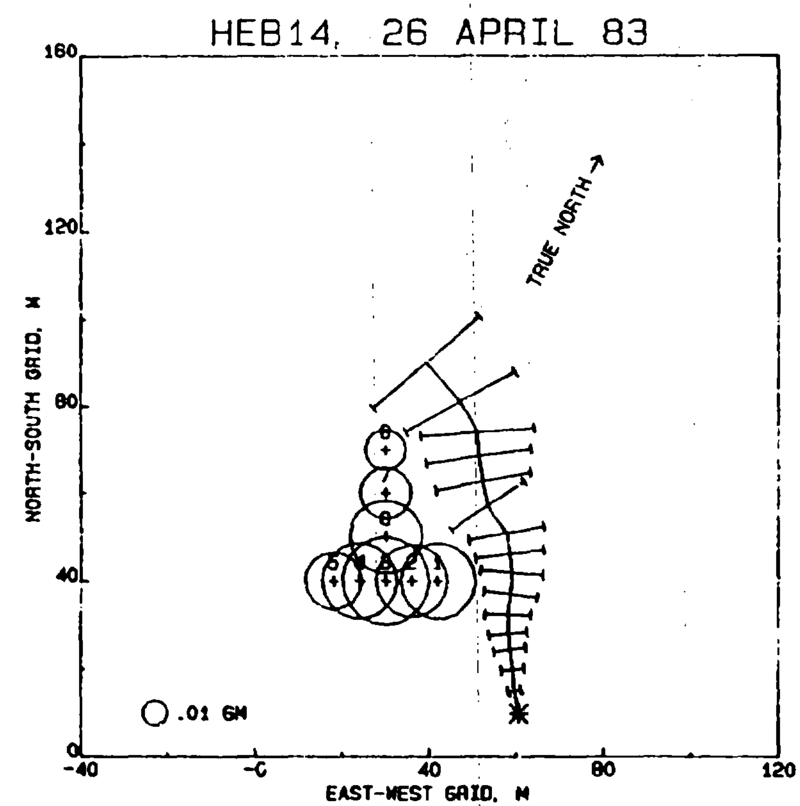
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0897	0.0805	0.1194	0.0896	0.0513	0.0846	0.0421	0.0260

SUM: 0.5832

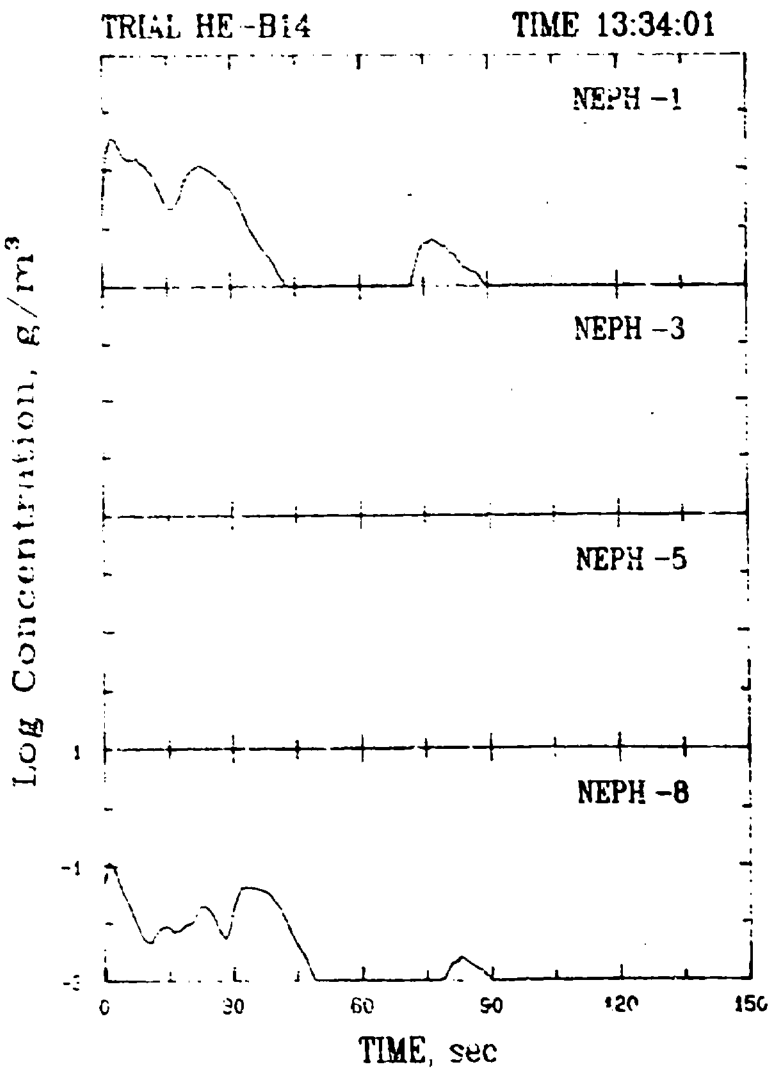
GELMAN DOSAGE (G S/M**3):

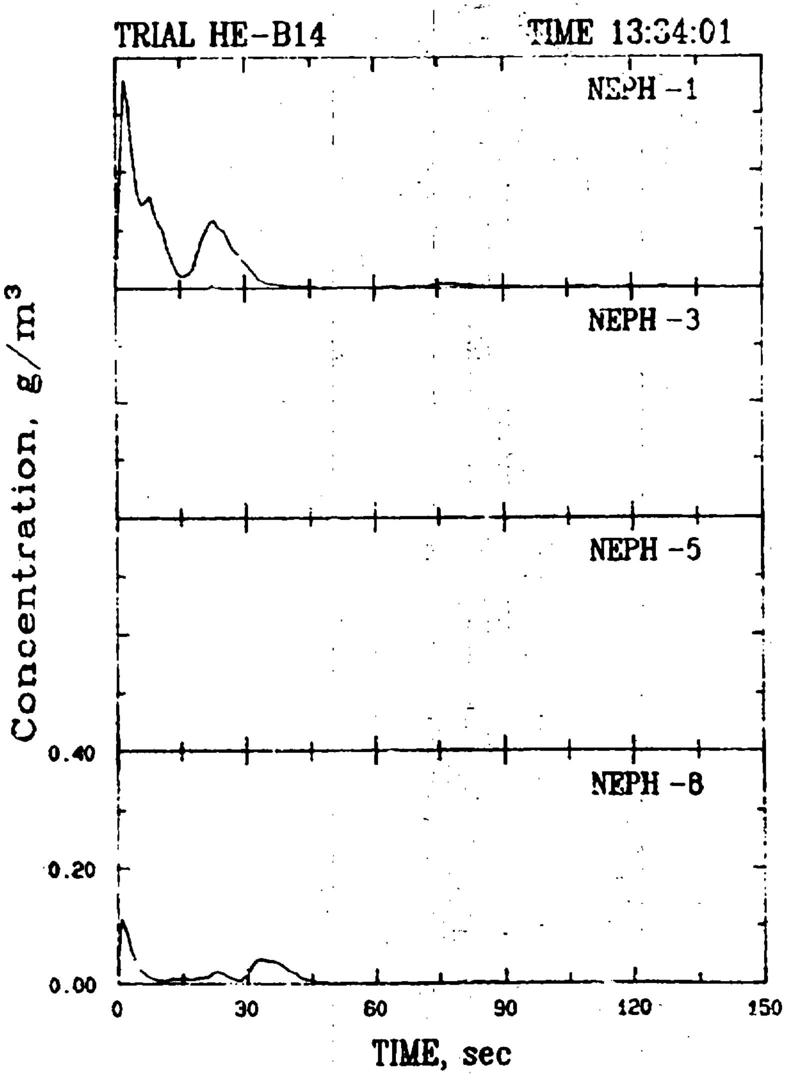
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

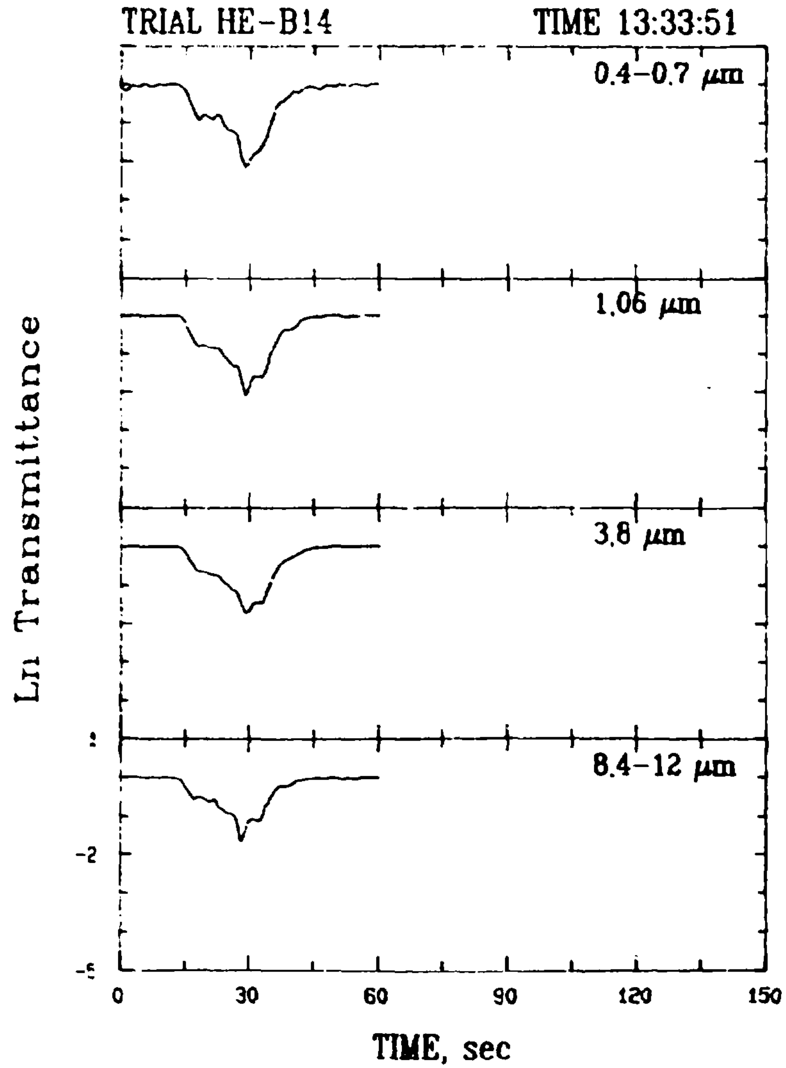


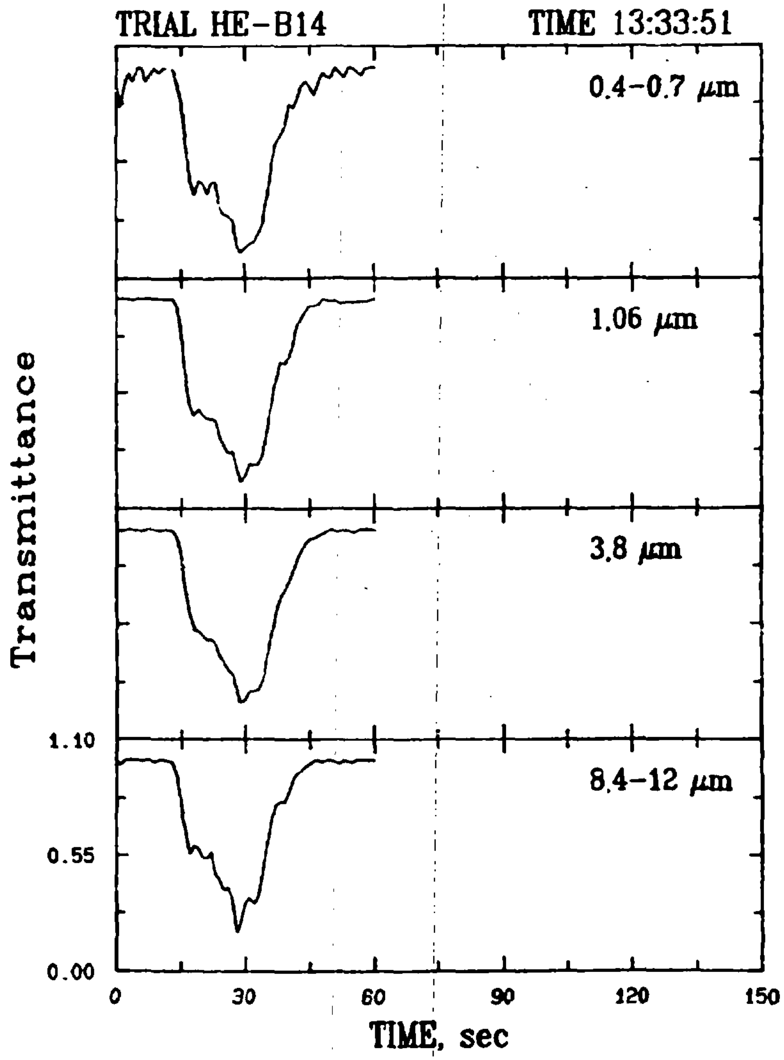


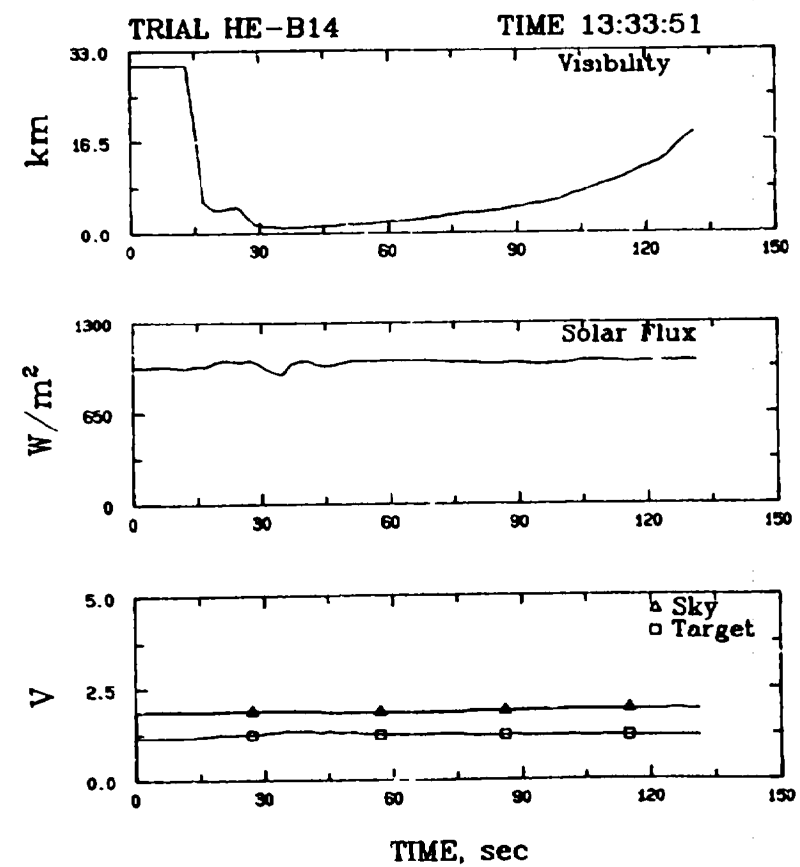
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B14
TIME 13:34:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-B14
TIME 13:34:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.40
0.20
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B14
TIME 13:33:51
0.4–0.7 μm
1.06 μm
3.8 μm
8.4–12 μm
Ln Transmittance
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B14
TIME 13:33:51
0.4–0.7 μm
1.06 μm
3.8 μm
8.4–12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B14
TIME 13:33:51
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB15

Surface Tangent Buried

Date: 26 APRIL 83

Charge Shape: BLOCK

Detonation Coordinates (M):
X: 36.1
Y: 2.8

Charge Wt: 15.0 LB
Event Time: 14:57:35

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.136

16 Meter Tower (Means)
Start Time: 14:56: 7 End Time: 14:59:43

	2M	4M	6M	16M
Wind Speed (M/S)	5.80	6.25	6.47	7.76
Wind Dir. (DEG)	155.4	156.8	157.7	157.8
Sigma WSP	1.12	1.13	1.12	0.93
Sigma WDIR	10.5	10.5	10.1	7.5
UVW Components				
U (N-S) (M/S)	5.19	5.64	5.88	7.11
V (E-W) (M/S)	-2.37	-2.45	-2.47	-2.95
W (Vert) (M/S)	0.18	0.41	0.05	*
Sigma U	1.14	1.12	1.05	0.88
Sigma V	1.03	1.14	1.19	1.04
Sigma W	0.24	0.35	0.40	*
Temperature (C)	17.3	16.6	16.1	15.3

Soil Temperature (C): 32.5

Solar Flux (W/M**2): 776.8

Dew Point (C): -1.2

Visual Range (M): 30480.0

Temperature (C): 16.7

Vista Ranger Voltages:
Sky: 1.92
Target: 1.12

Rel. Hum. (%): 29.3

Abs. Hum. (G/M**3): 4.17

Sky-Target Contrast: -0.41

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	36.0	3.0	25	190	230	380
Post-Shot	36.0	3.0	25	165	350	685

CRATER DATA

Moisture Content: *

CRATER VOLUMES (M**3):
True Crater: 1.832
Apparent Crater: 0.810
Flow: 1.021

DENSITIES (G/CM**3):
Pre-Shot: 1.26
Flow: 1.12
Bottom: 1.122
Side: 1.113

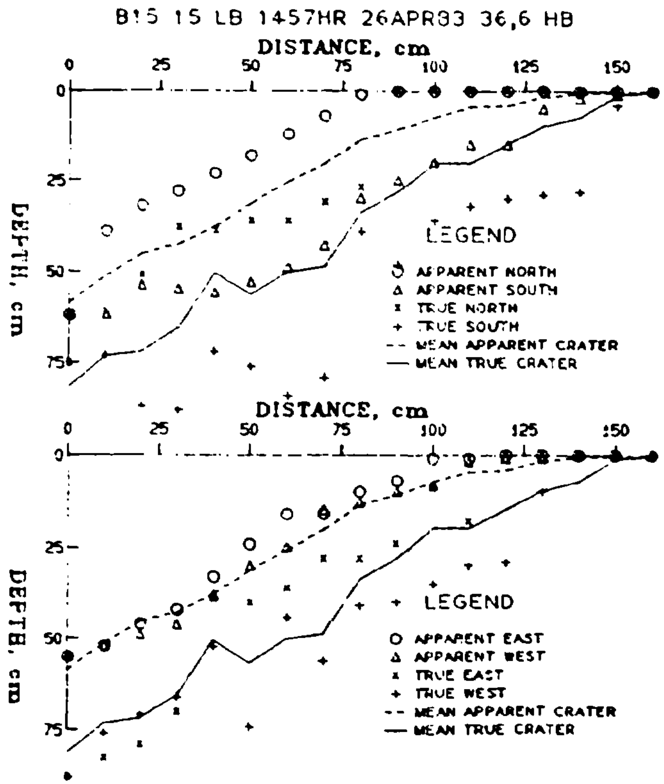
HI VOL DATA (G):

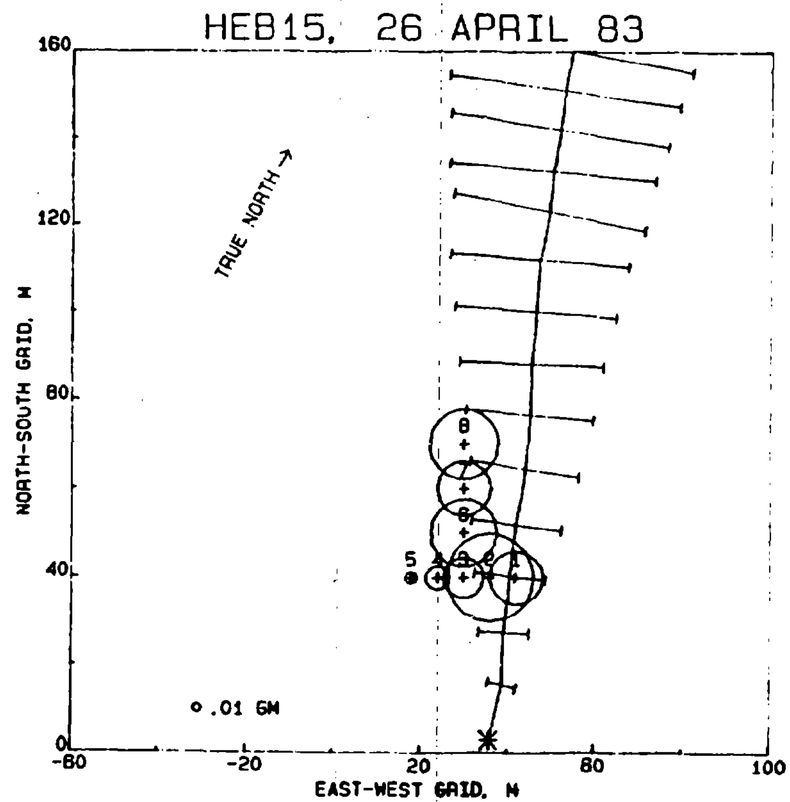
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.3737	1.0164	0.2213	0.0798	0.0174	0.6042	0.3817	0.6498

SUM: 3.3443

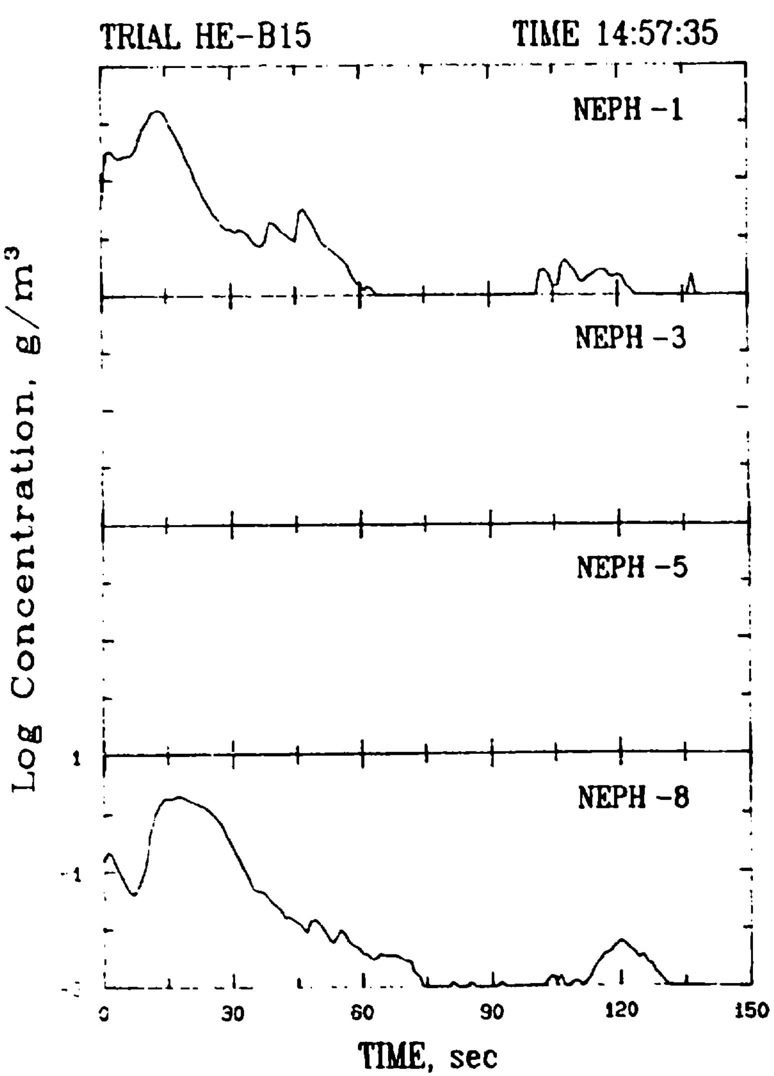
GELMAN DOSAGE (G S/M**3):

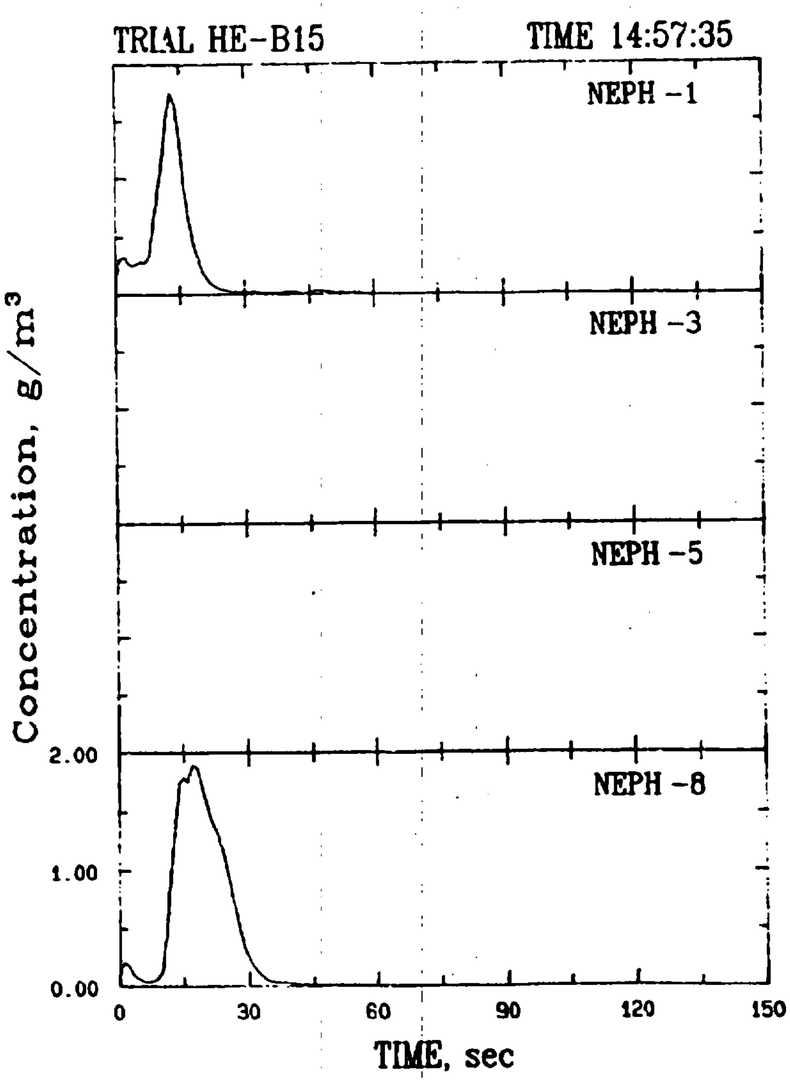
GELMAN A	GELMAN B	GELMAN C	GELMAN D
79.621	153.600	183.064	72.973

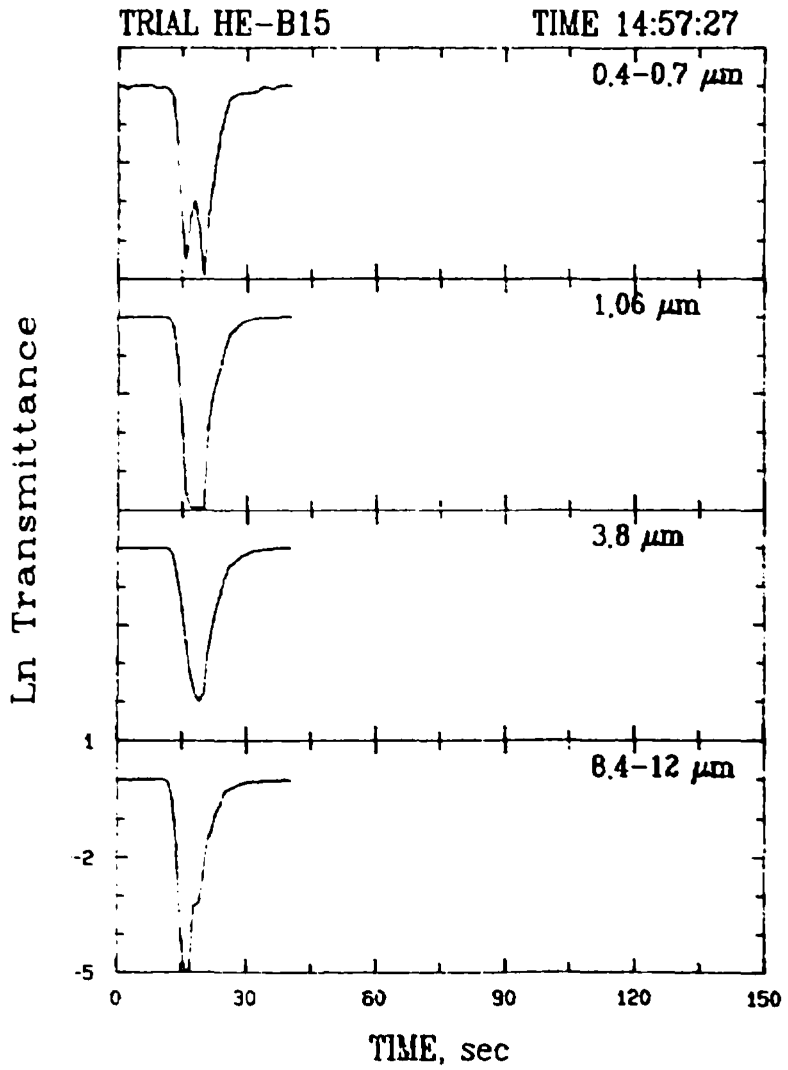




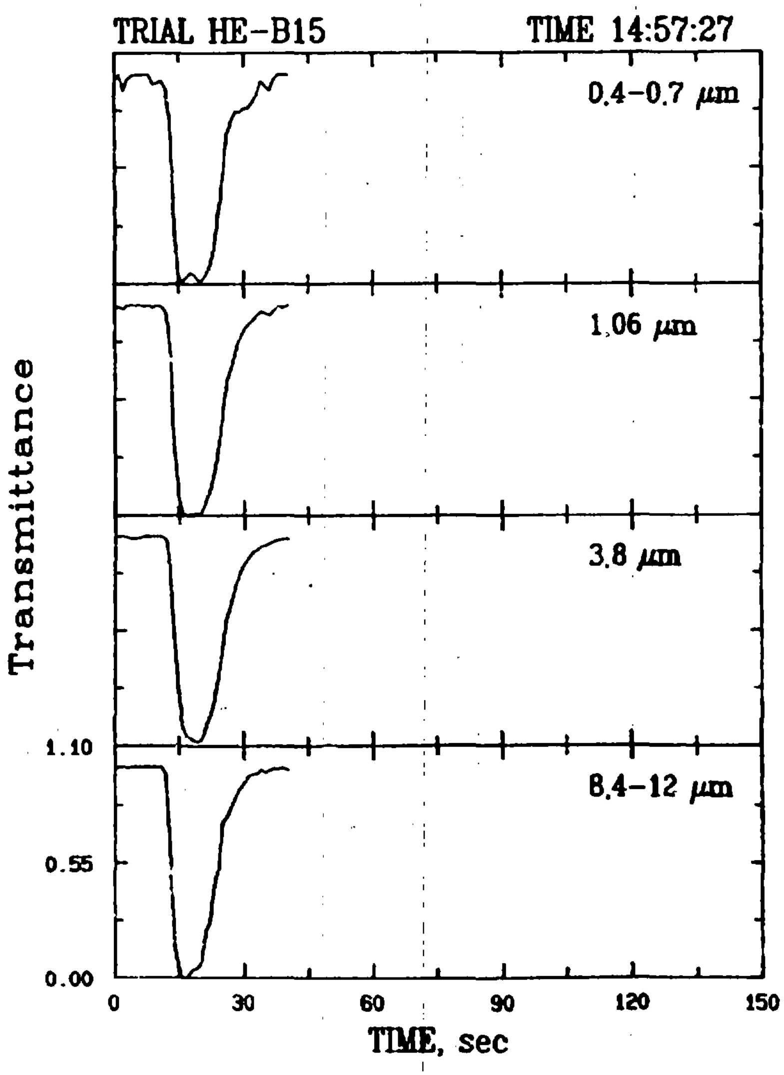
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B15
TIME 14:57:35
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
0
30
60
90
120
150
TIME, sec

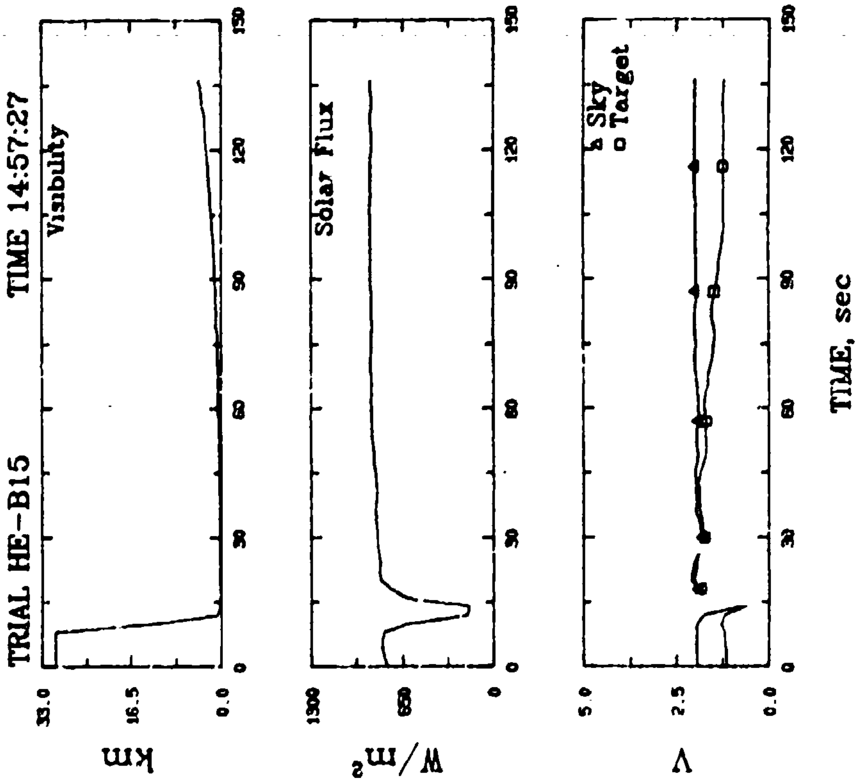

TRIAL HE-B15
TIME 14:57:35
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
2.00
1.00
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-B15
TIME 14:57:27
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-B15
TIME 14:57:27
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B15
TIME 14:57:27
Visibility
Solar Flux
Sky
Target
km
W/m²
V
33.0
16.5
0.0
1300
650
0
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEB16 (3 Charges)

Surface Tangent

Date: 26 APRIL 83

Detonation Coordinates (M):

X:	44.0	54.8	65.9
Y:	10.0	9.4	9.2

Charge Shape: BLOCK

Charge Wt: 15.0 LB

Event Time: 16:25:56
16:26:01
16:26:06

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.243

16 Meter Tower (Means)
Start Time: 16:23:43 End Time: 16:28:18

	2M	4M	6M	16M
Wind Speed (M/S)	3.03	3.26	3.33	3.65
Wind Dir. (DEG)	145.0	146.1	145.8	141.0
Sigma WSP	1.34	1.51	1.50	1.69
Sigma WDIR	11.0	9.9	10.2	13.0
UVW Components				
U (N-S) (M/S)	2.49	2.72	2.79	2.92
V (E-W) (M/S)	-1.63	-1.71	-1.74	-2.03
W (Vert) (M/S)	0.09	0.22	0.03	*
Sigma U	1.28	1.44	1.45	1.74
Sigma V	0.67	0.71	0.68	0.72
Sigma W	0.12	0.20	0.25	*
Temperature (C)	16.4	15.9	15.7	15.6

Soil Temperature (C): 25.1

Dew Point (C): -1.5

Temperature (C): 15.4

Rel. Hum. (%): 31.0

Abs. Hum. (G/M**3): 4.08

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 266.2

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.32
Target: 0.67

Sky-Target Contrast: -0.49

CONE INDEX:

	X,Y Coord (M)		SPC	15	30	45
Pre-Shot	44.0	10.0	*	*	*	*
Post-Shot	44.0	10.0	*	*	*	*

CRATER DATA

Moisture Content: *

CRATER VOLUMES (M**3):
True Crater: *
Apparent Crater: *
Flow: *

DENSITIES (G/CM**3):
Pre-Shot: *
Flow: *
Bottom: *
Side: *

HI VOL DATA (G):

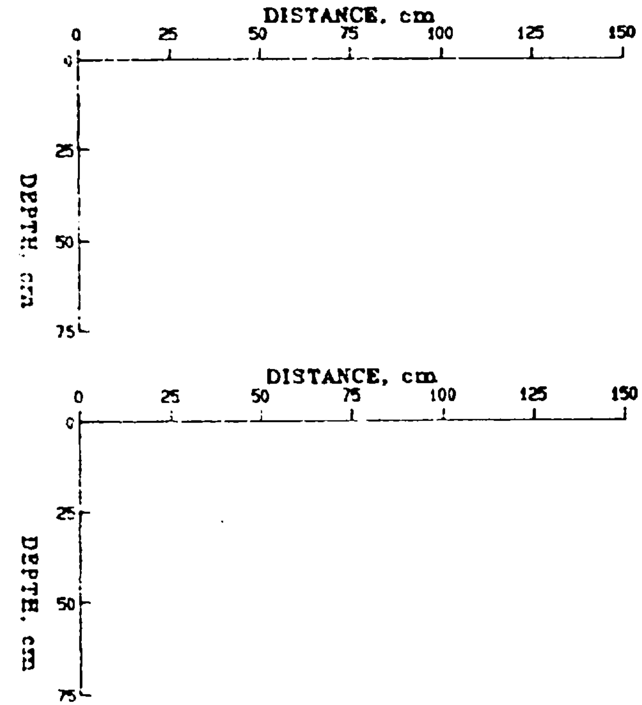
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.4340	0.4678	0.2088	0.0399	0.1217	0.3024	0.2406	0.2521

SUM: 2.0673

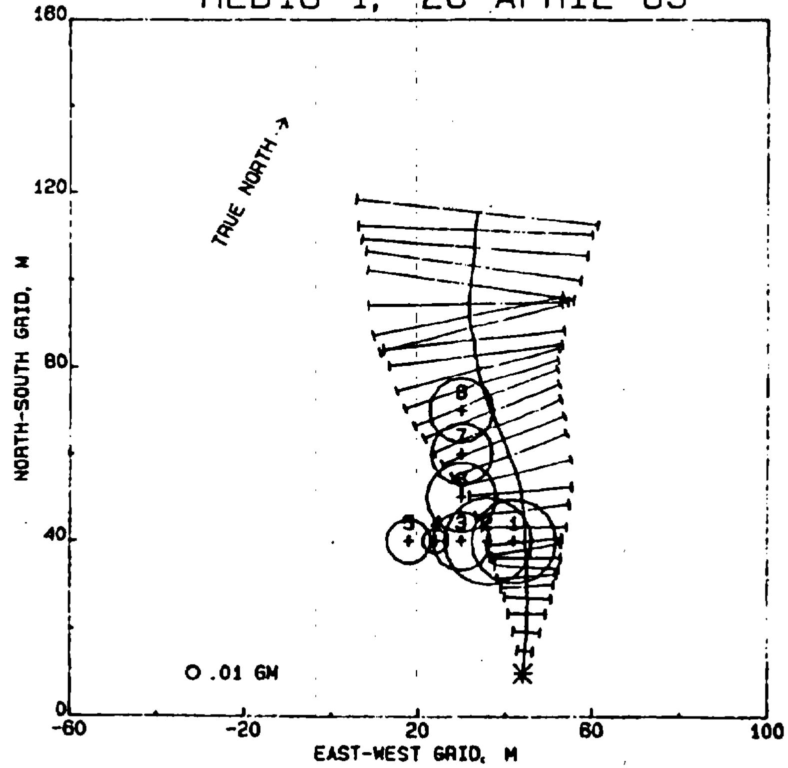
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
152.607	27.200	29.888	8.108

NO DATA FOR 916

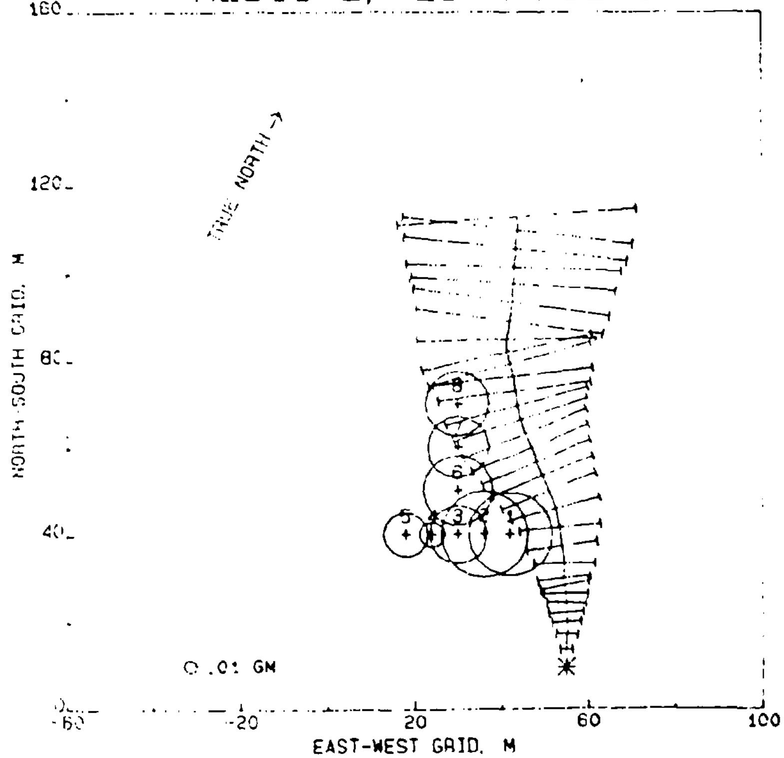


HEB16-1, 26 APRIL 83



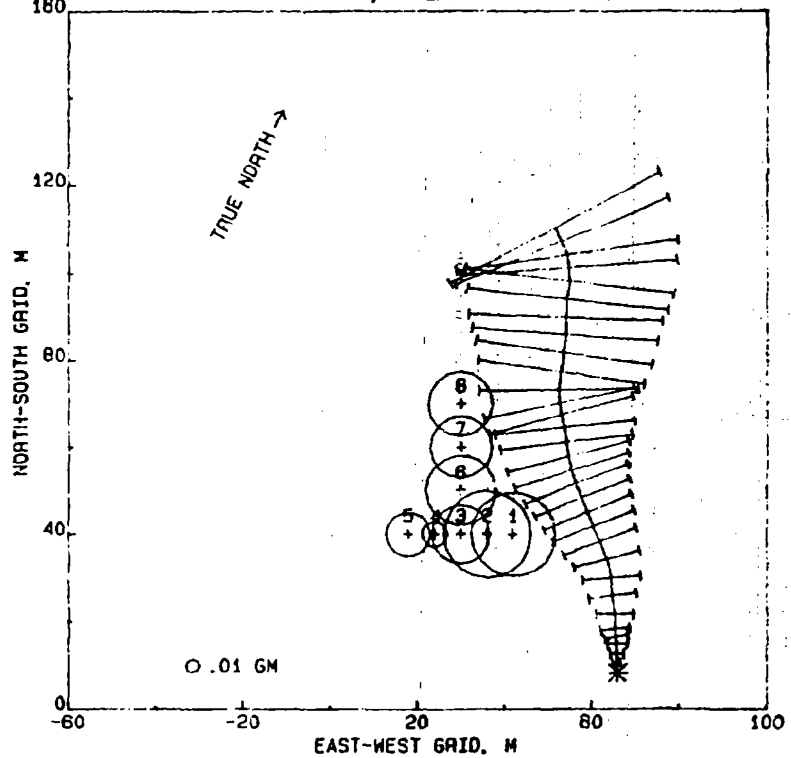
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

HEB16-2, 26 APRIL 83

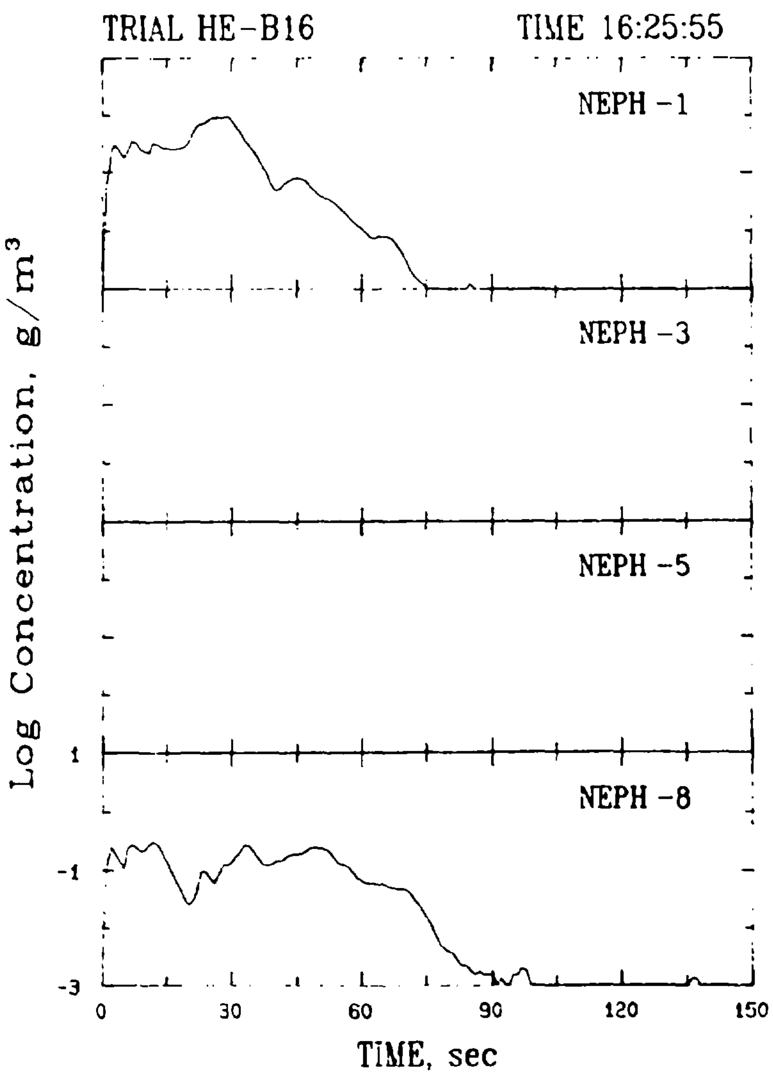


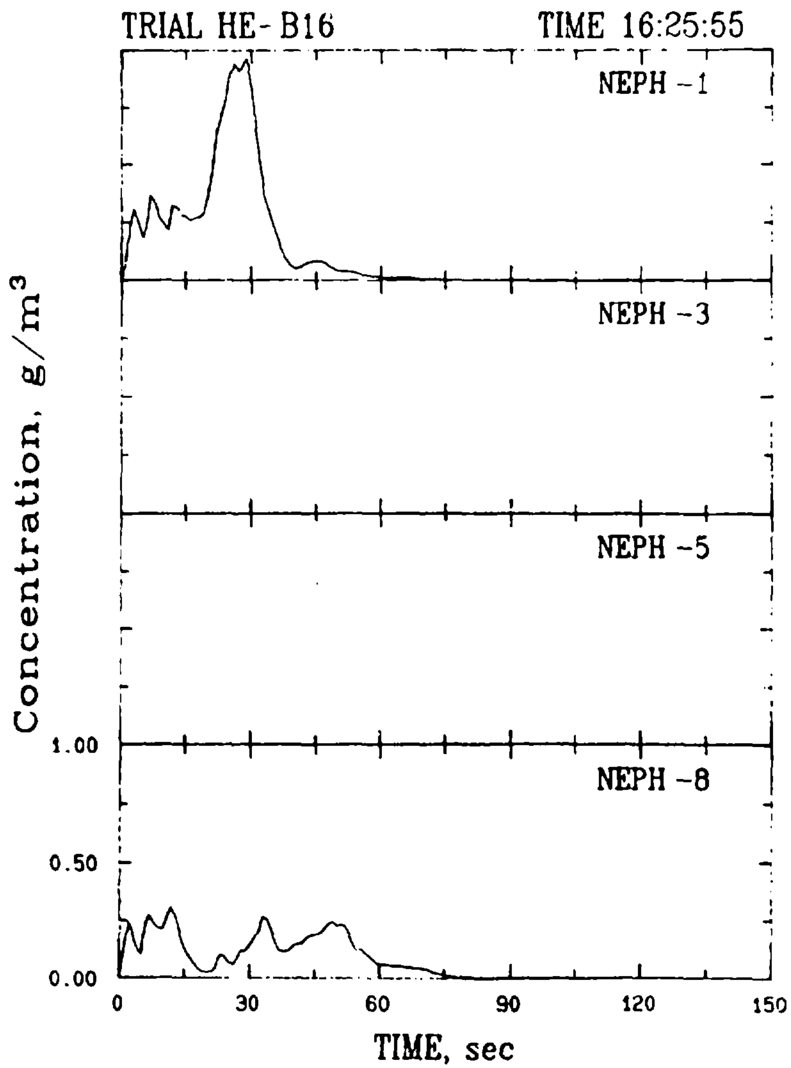
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

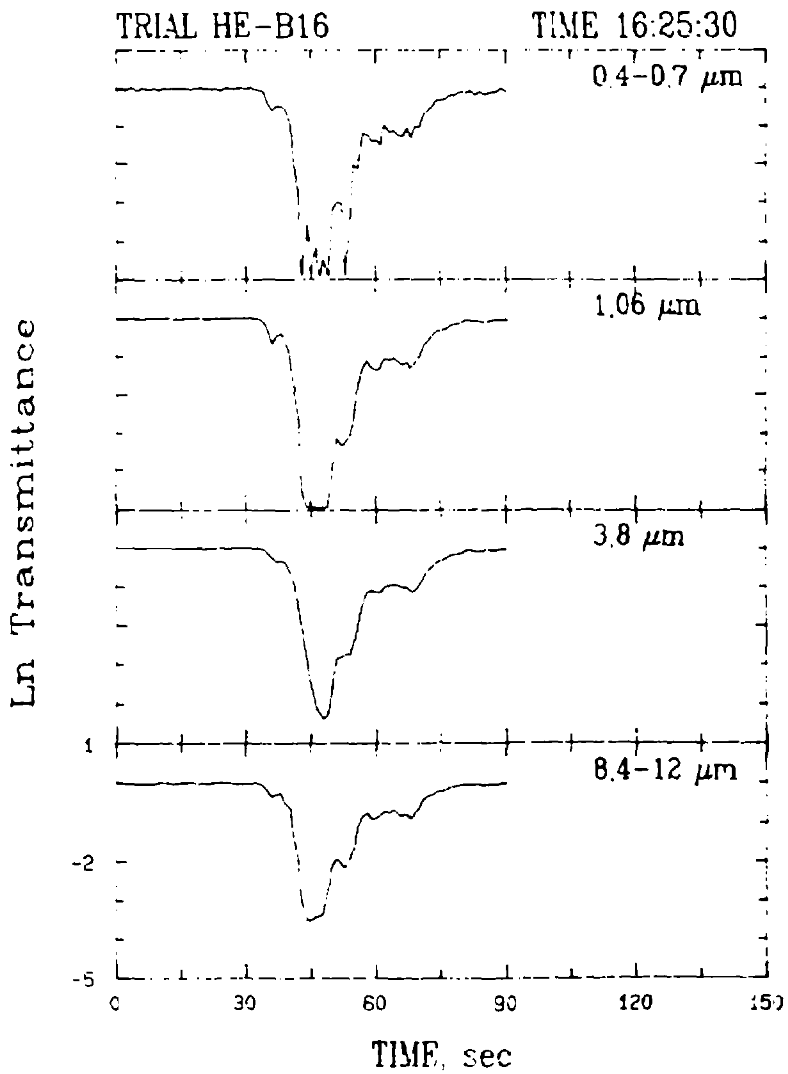
HEB16-3, 26 APRIL 83

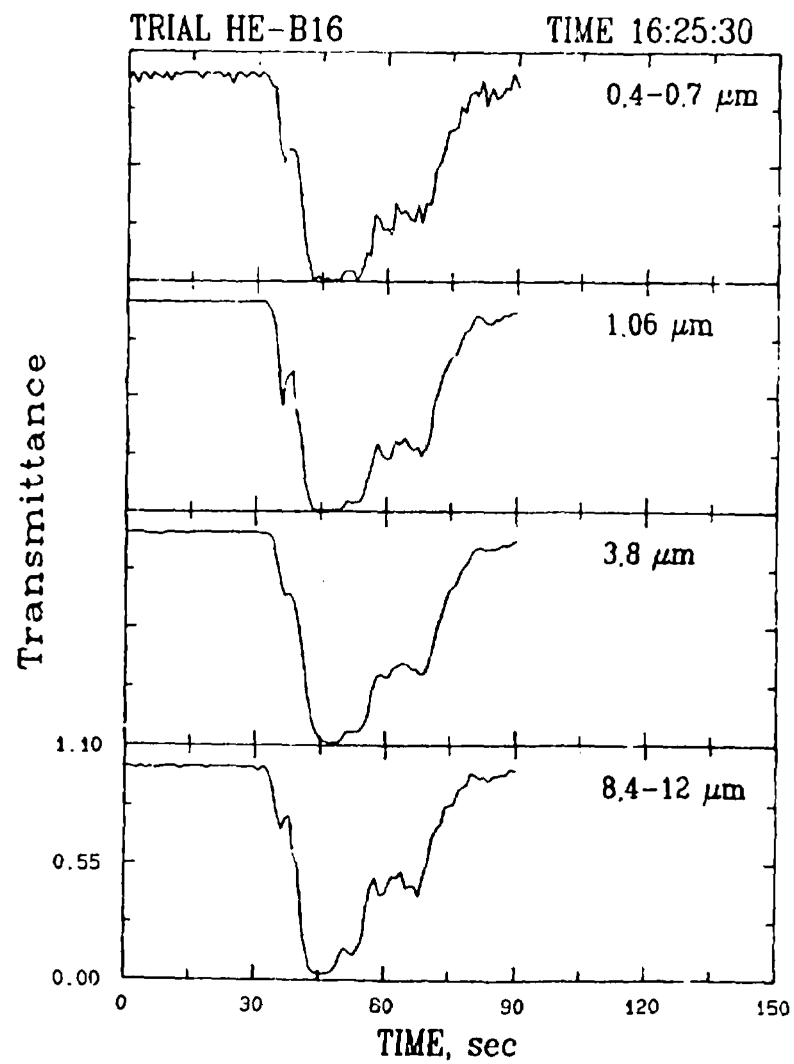


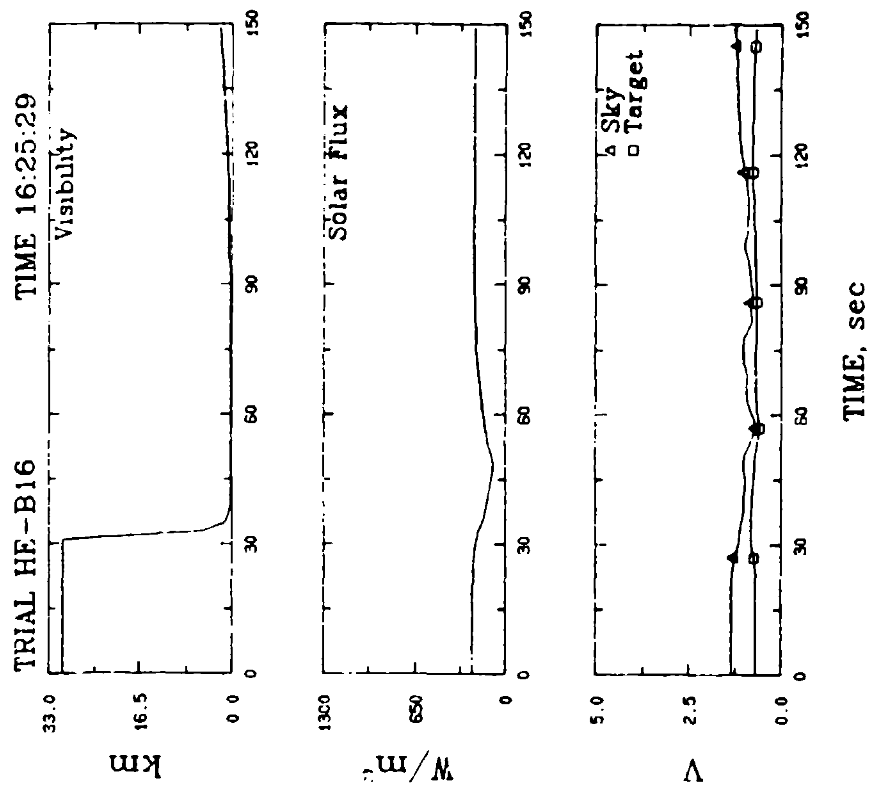
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-B16
TIME 16:25:55
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

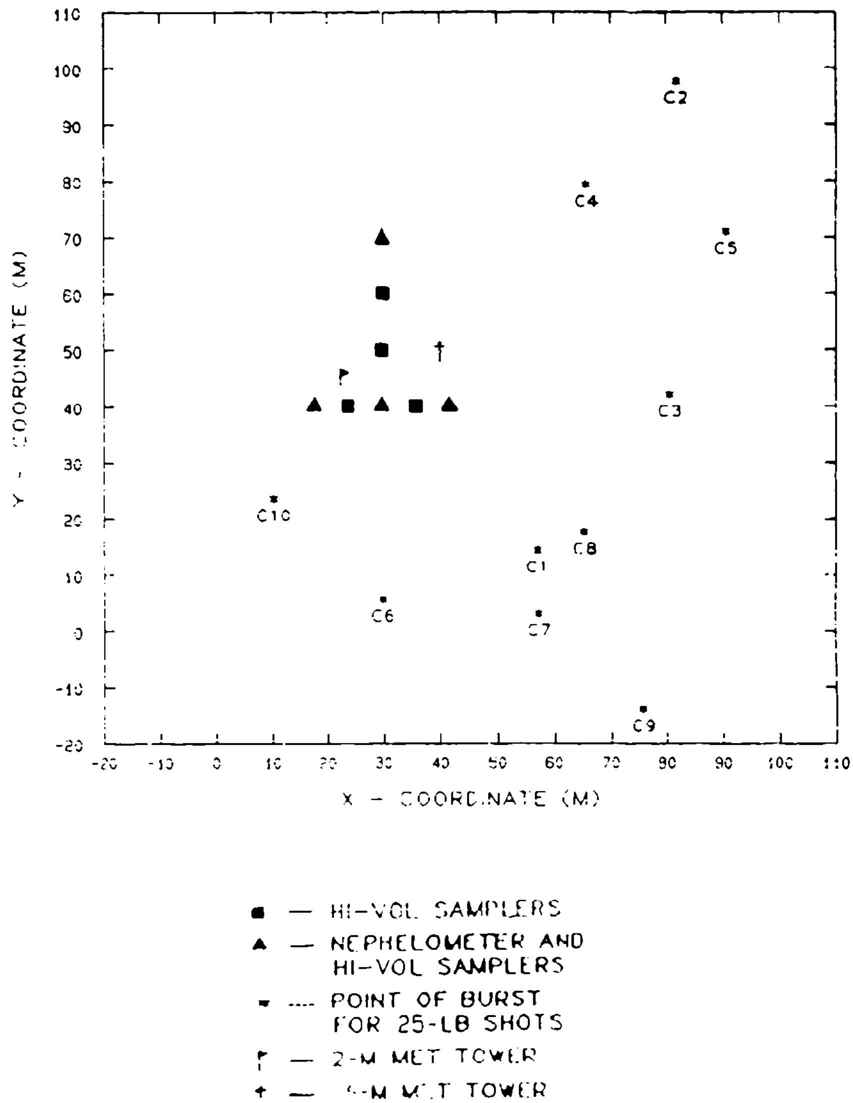

TRIAL HE- B16
TIME 16:25:55
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
1.00
0.50
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B16
TIME 16:25:30
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-B16
TIME 16:25:30
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-B16
TIME 16:25:29
Visibility
Solar Flux
Sky
Target
km
W/m²
V
TIME, sec

APRIL (DOT I) 25 LB SHOTS



EVENT SUMMARY DATA

Test Number: HEC1

Surface Tangent

Date: 20 APRIL 83

Charge Shape: SPHERICAL

Detonation Coordinates (M):
X: 57.0
Y: 4 3

Charge Wt: 25.0 LB
Event Time: 14:43:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.636

16 Meter Tower (Means)
Start Time: 14:41: 1 End Time: 14:44:57

	2M	4M	6M	16M
Wind Speed (M/S)	2.81	2.90	3.09	3.44
Wind Dir. (DEG)	108.9	110.8	111.5	114.6
Sigma WSP	0.73	0.87	0.94	1.17
Sigma WDIR	14.2	14.0	12.4	10.7
UVW Components				
U (N-S) (M/S)	0.85	0.97	1.07	1.45
V (E-W) (M/S)	-2.58	-2.64	-2.83	-3.06
W (Vert) (M/S)	0.10	0.08	0.12	*
Sigma U	0.67	0.71	0.64	0.80
Sigma V	0.77	0.88	0.96	1.06
Sigma W	0.13	0.16	0.20	*
Temperature (C)	19.7	19.3	19.1	18.9

Soil Temperature (C): 27.8

Solar Flux (W/M**2): 142.6

Dew Point (C): -1.6

Visual Range (M): 30480.0

Temperature (C): 18.6

Vista Ranger Voltages:
Sky: 1.60
Target: 0.70

Rel. Hum. (%): 25.0

Abs. Hum. (G/M**3): 4.00

Sky-Target Contrast: -0.56

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SPC	15	30	45
Pre-Shot	60.0	20.0	50	104	160	260
Post-Shot	60.0	20.0	38	118	175	215

CRATER DATA

Moisture Content: 23.6

CRATER VOLUMES (M**3):
True Crater: 0.893
Apparent Crater: 0.465
Flow: 0.428

DENSITIES (G/CM**3):
Pre-Shot: 1.440
Flow: 0.986
Bottom: 0.970
Side: 1.018

HI VOL DATA (G):

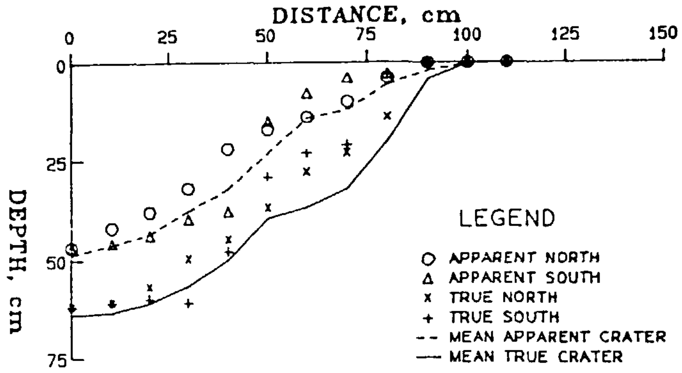
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.7296	0.6773	0.2279	0.0770	0.0601	0.5893	0.4019	0.0756

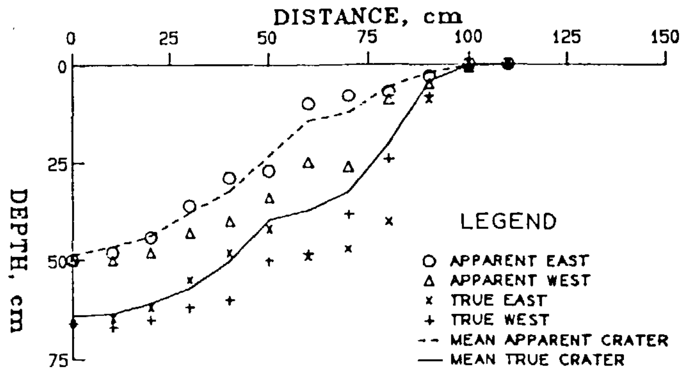
SUM: 2.8387

GELMAN DOSAGE (G S/M**3):

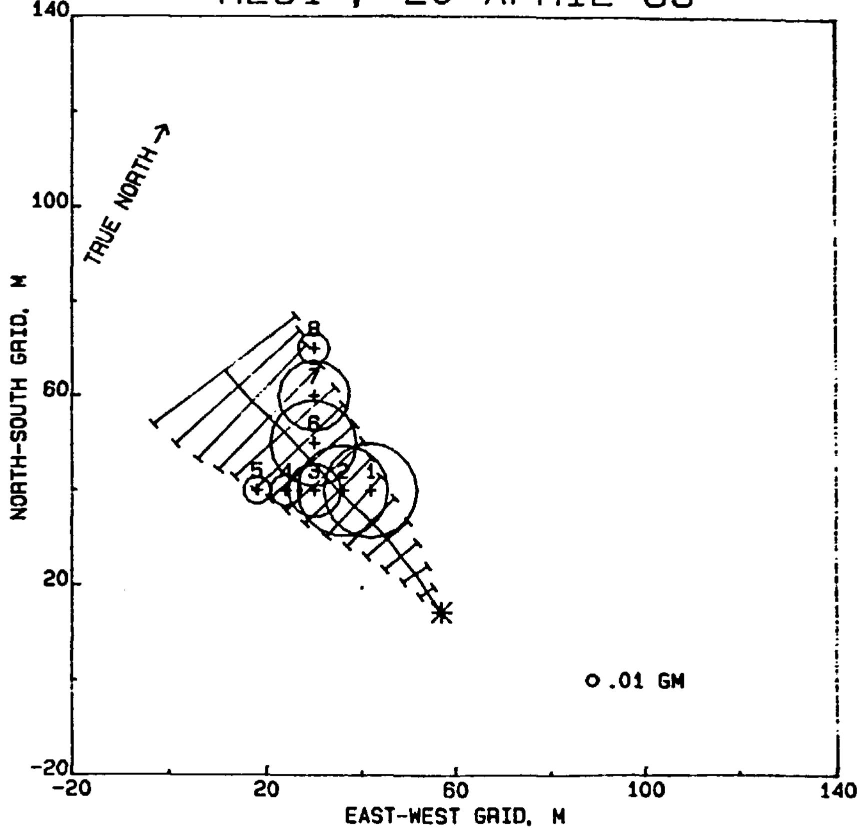
GELMAN A	GELMAN B	GELMAN C	GELMAN D
50.113	46.400	41.843	8.108

C1 25LB 1443HR 20APR83 60,20

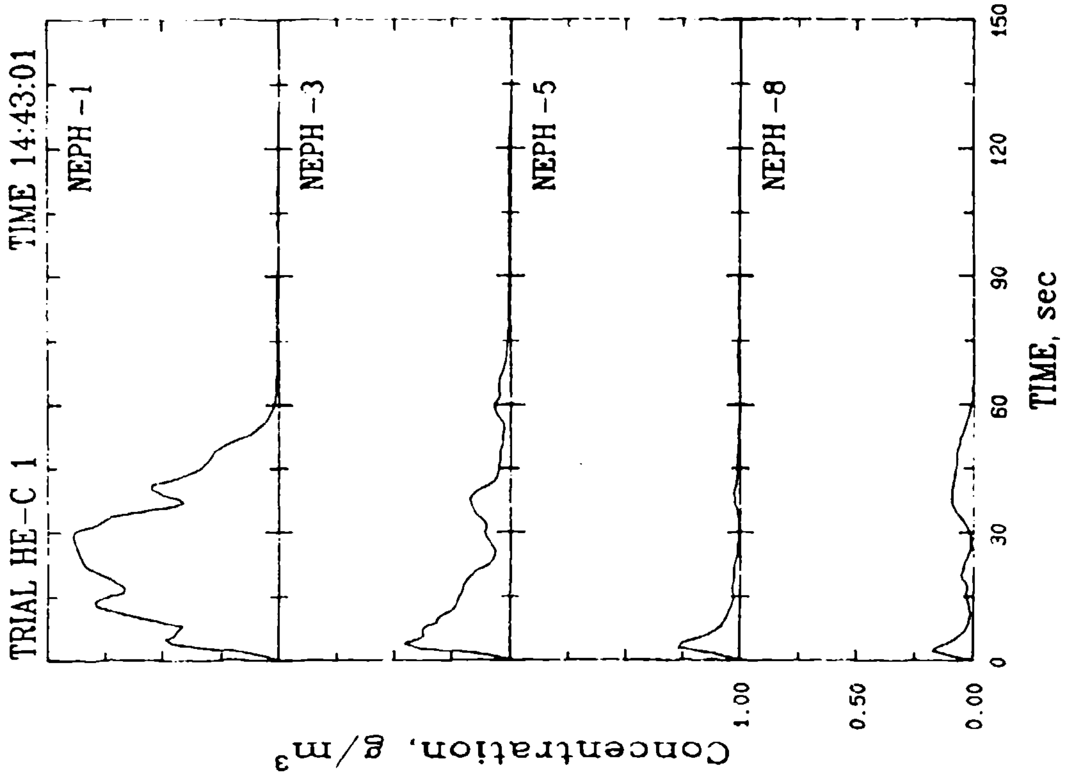




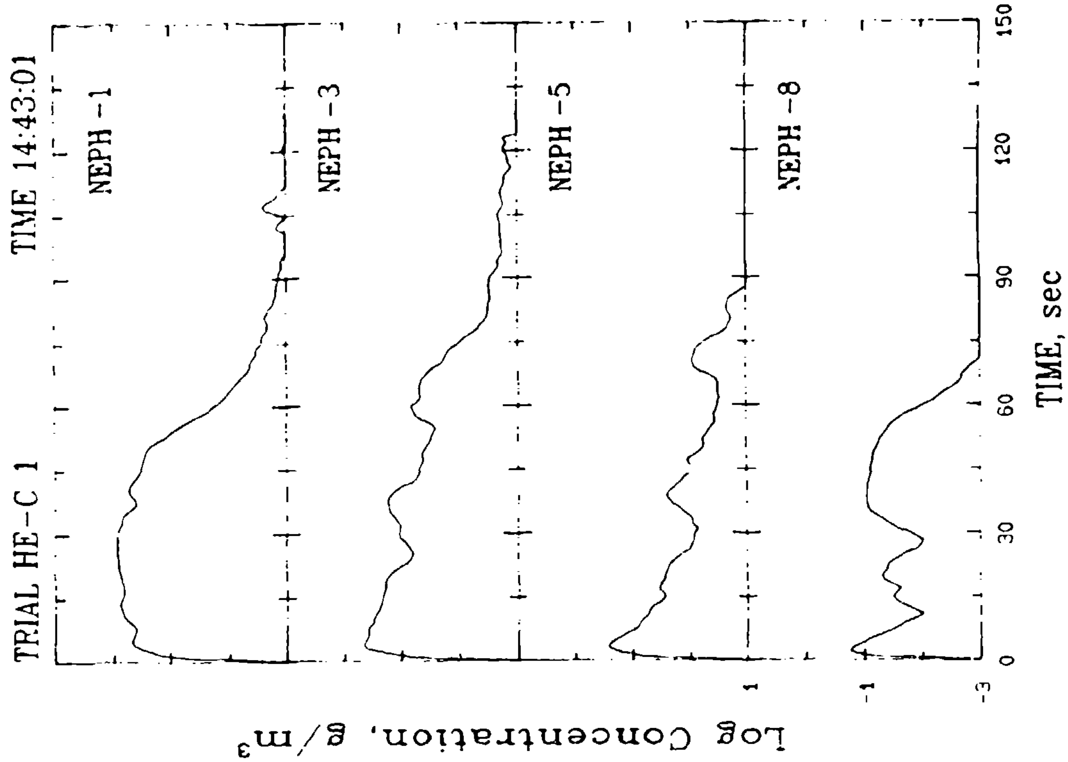
HEC1 , 20 APRIL 83



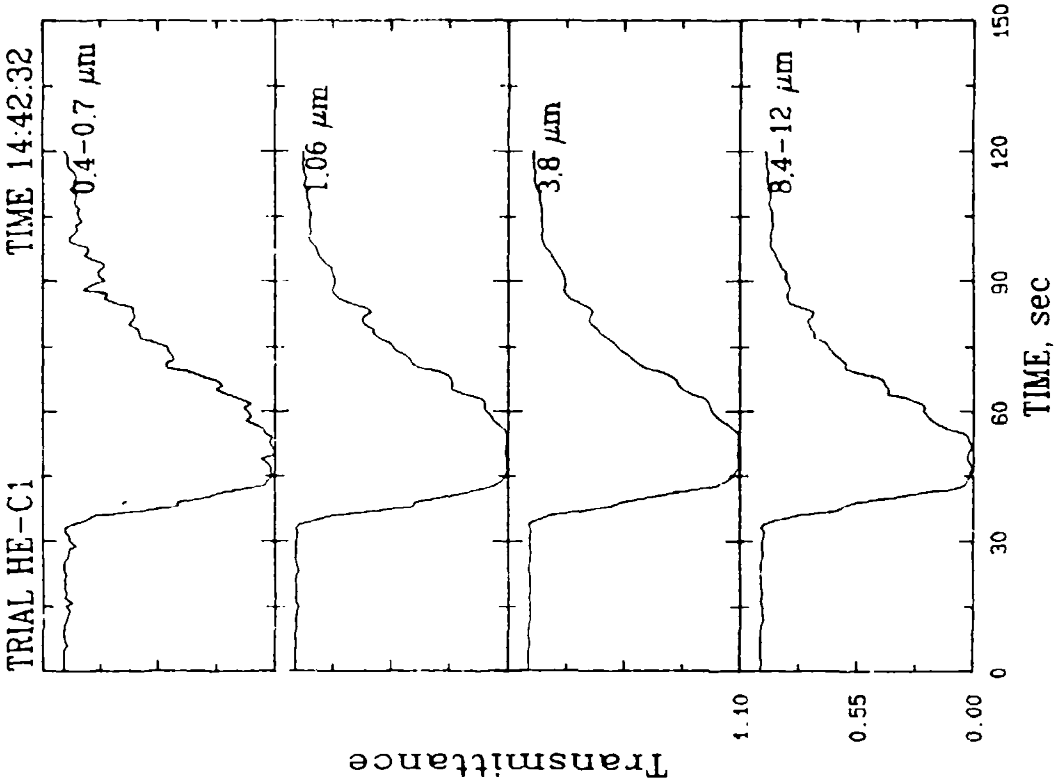
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS



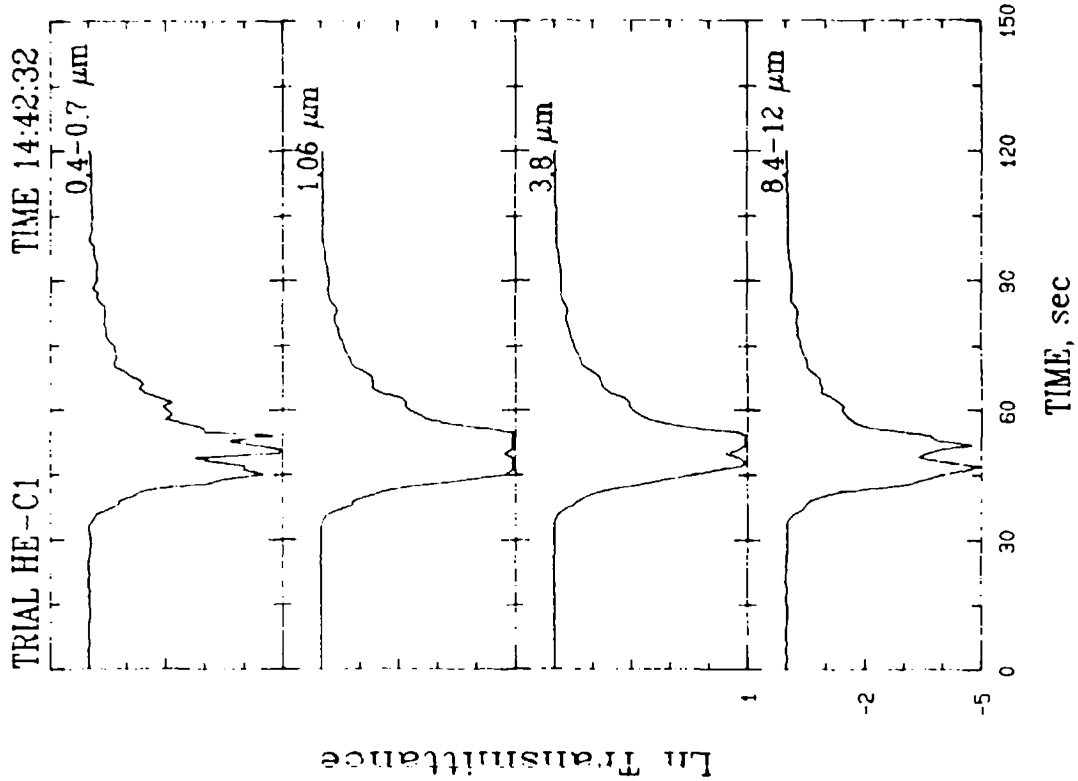
TRIAL HE-C 1
TIME 14:43:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
1.00
0.50
0.00
0
30
60
90
120
150
TIME, sec



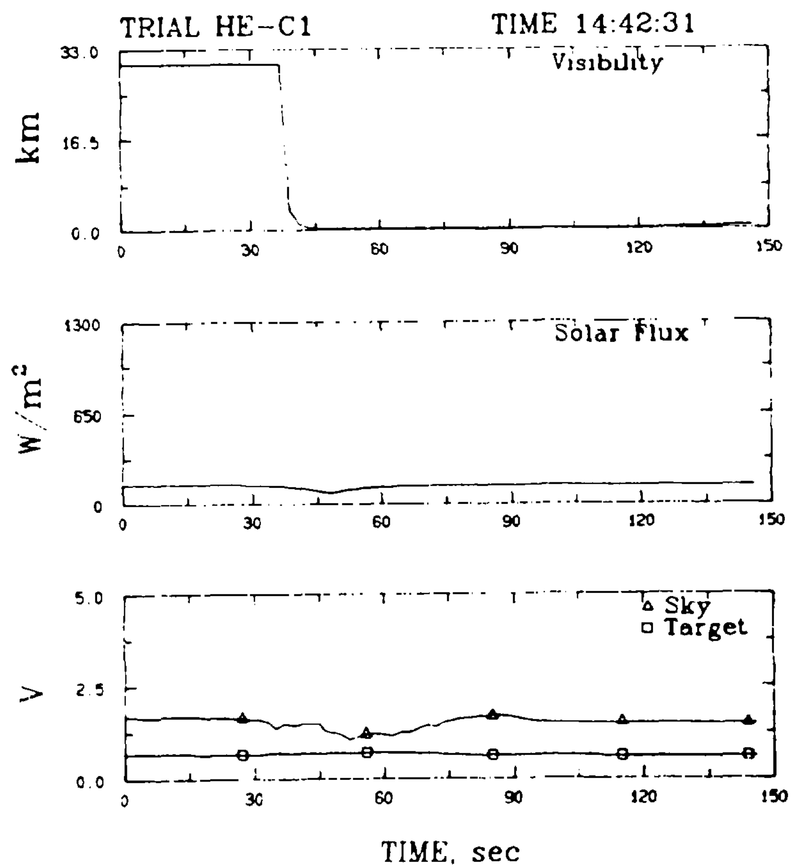
TRIAL HE-C 1
TIME 14:43:01
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



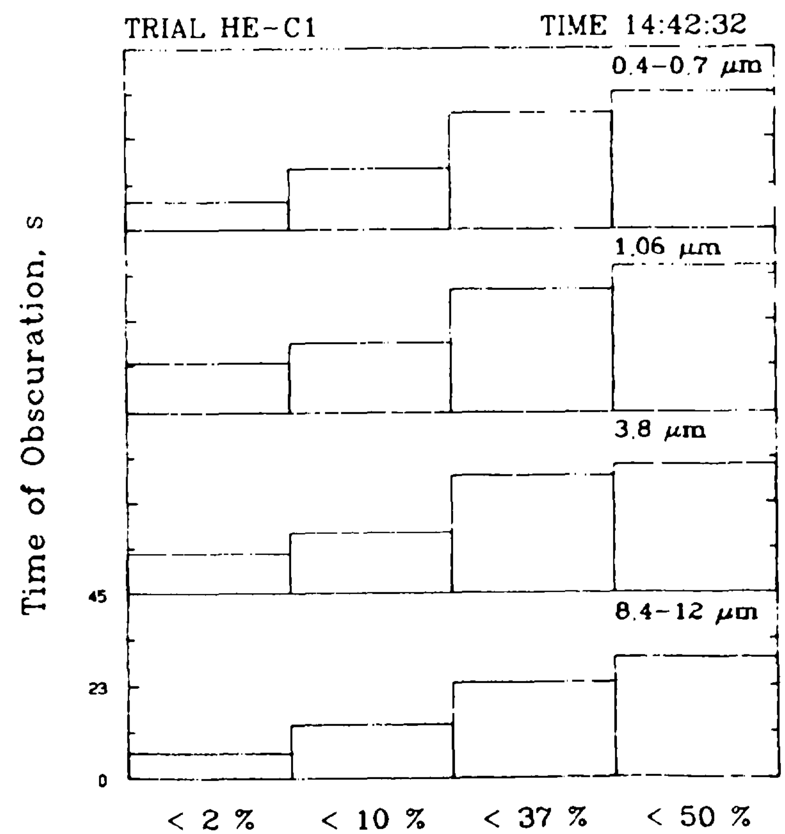
TRIAL HE-C1
TIME 14:42:32
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C1
TIME 14:42:32
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-C1
TIME 14:42:31
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec



TRIAL HE-C1
TIME 14:42:32
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
45
23
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC2

Date: 21 APRIL 83
Detonation Coordinates (M):
X: 81.7
Y: 97.7

Surface Tangent

Charge Shape: BLOCK

Charge Wt: 25.0 LB
Event Time: 14:27:45

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.858

16 Meter Tower (Means)
Start Time: 14:26:37 End Time: 14:29:48

	2M	4M	6M	16M
Wind Speed (M/S)	4.43	4.83	4.96	5.56
Wind Dir. (DEG)	55.7	52.8	56.7	53.4
Sigma WSP	0.88	0.87	0.94	0.91
Sigma WDIR	14.1	12.8	12.6	14.7
UVW Components				
U (N-S) (M/S)	-2.37	-2.82	-2.62	-3.25
V (E-W) (M/S)	-3.60	-3.78	-4.08	-4.29
W (Vert) (M/S)	0.39	0.16	0.62	*
Sigma U	0.85	0.90	0.88	1.35
Sigma V	1.07	1.00	1.09	0.96
Sigma W	0.24	0.34	0.37	*
Temperature (C)	19.1	18.4	18.0	17.5

Soil Temperature (C): 27.2

Dew Point (C): 1.1

Temperature (C): 18.3

Rel. Hum. (%): 31.6

Abs. Hum. (G/M**3): 4.95

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 756.4

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.95
Target: 0.80

Sky-Target Contrast: -0.59

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	83.0 98.0	*	*	*	*
Post-Shot	83.0 98.0	25	138	163	167

CRATER DATA

Moisture Content: 11.2

CRATER VOLUMES (M**3):
True Crater: 1.350
Apparent Crater: 0.440
Flow: 0.910

DENSITIES (G/CM**3):
Pre-Shot: 1.840
Flow: 0.958
Bottom: 1.056
Side: 0.860

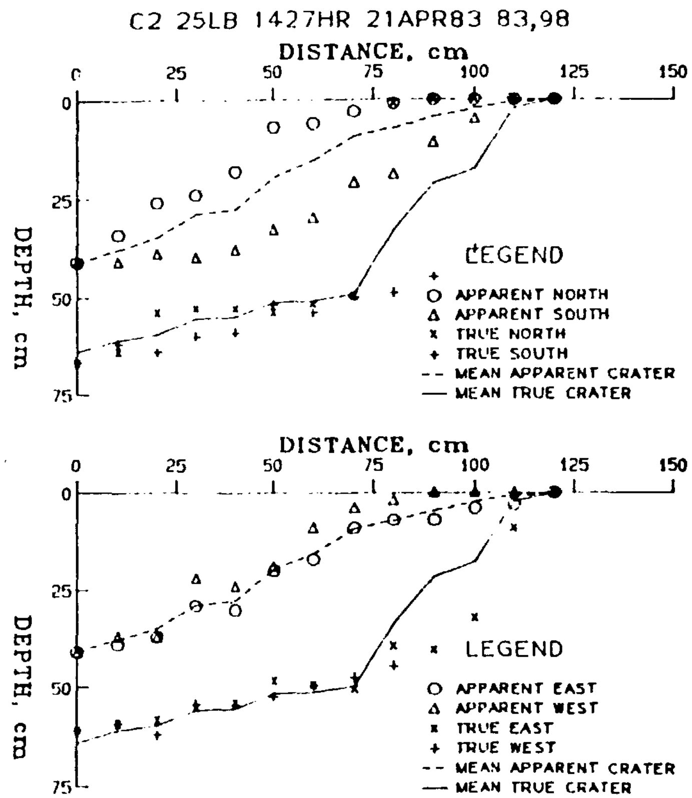
HI VOL DATA (G):

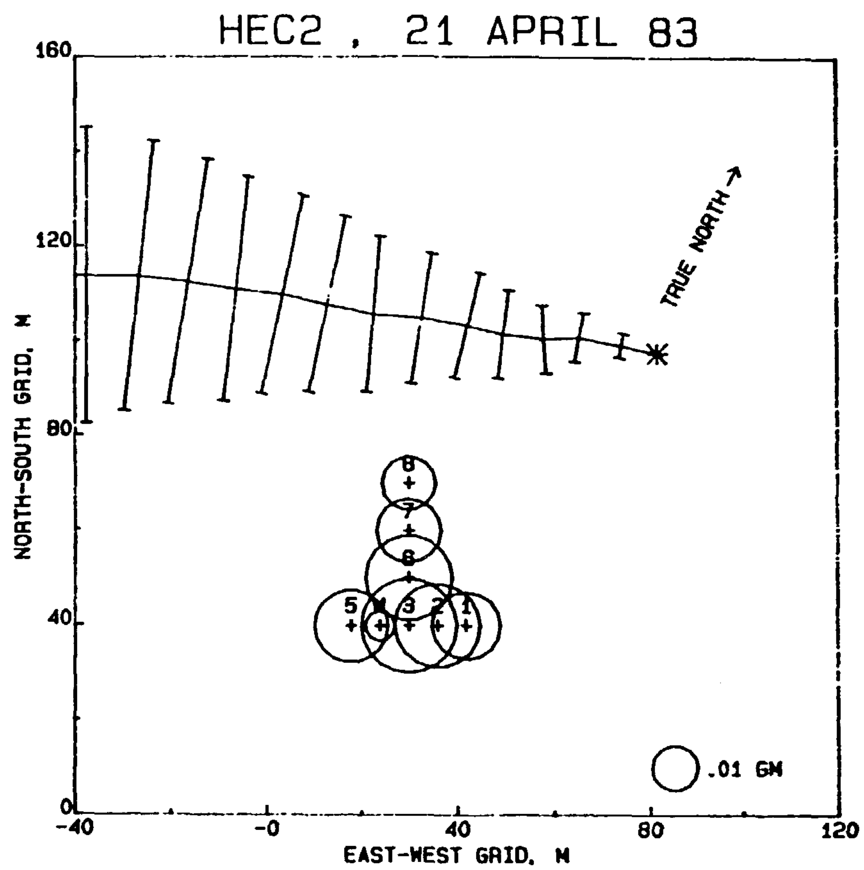
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0218	0.0344	0.0438	0.0042	0.0256	0.0362	0.0196	0.0138

SUM: 0.1994

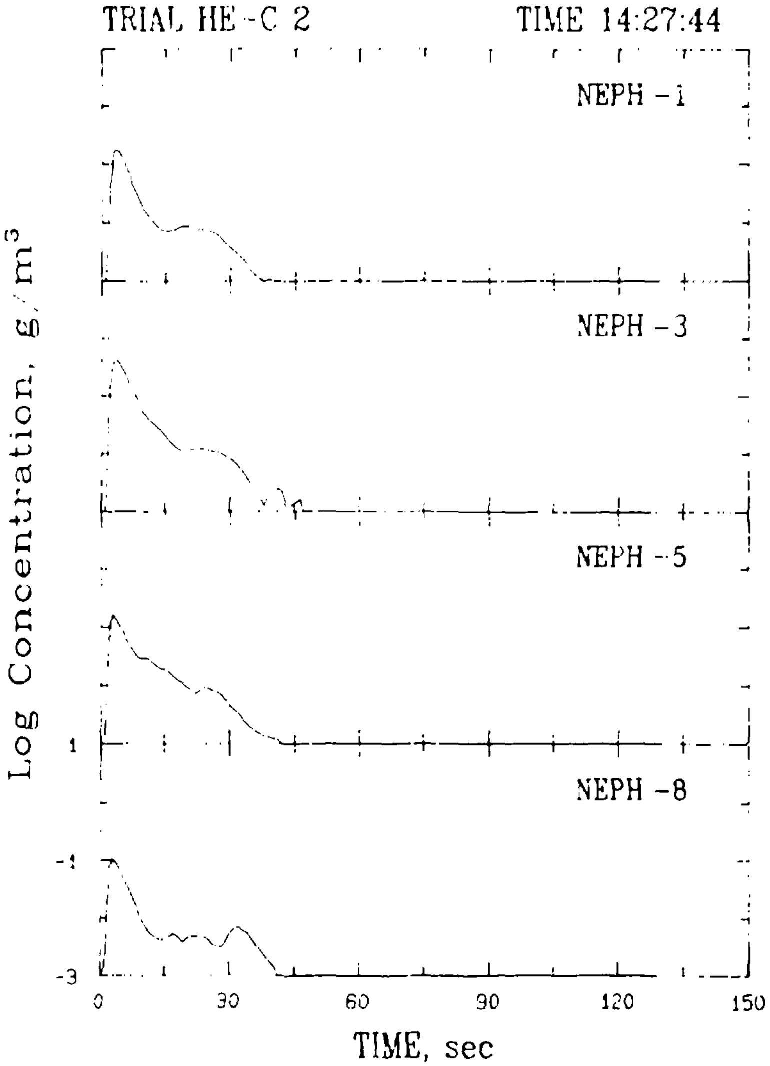
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

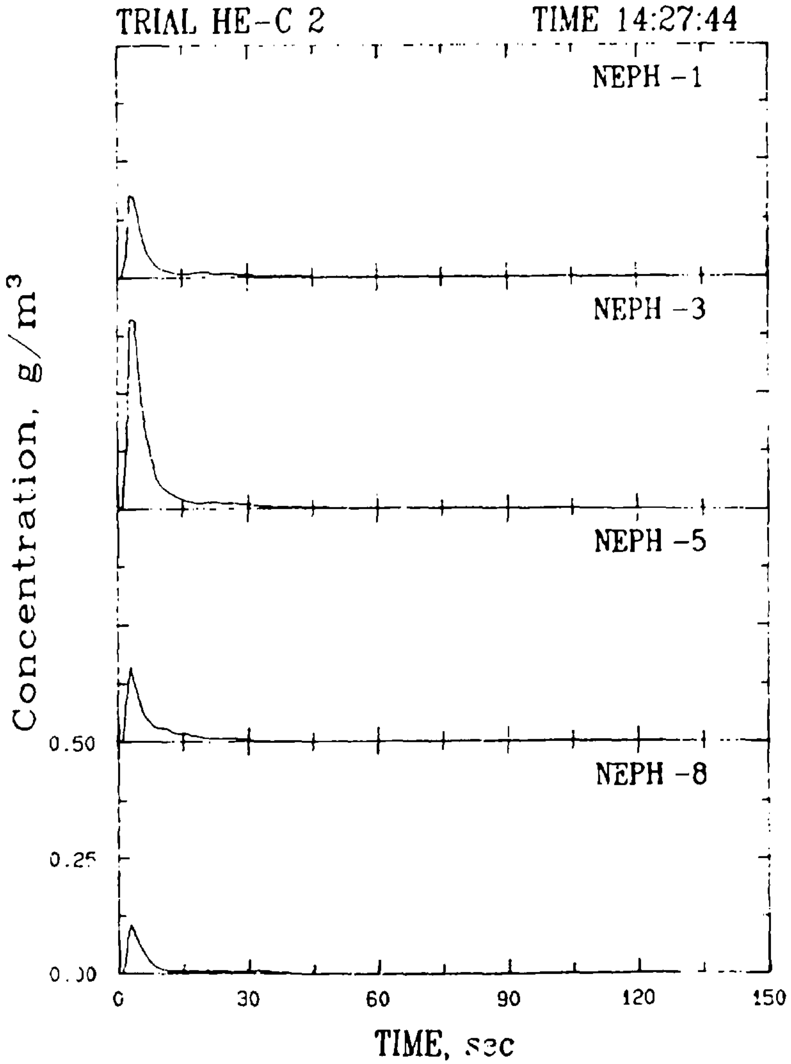




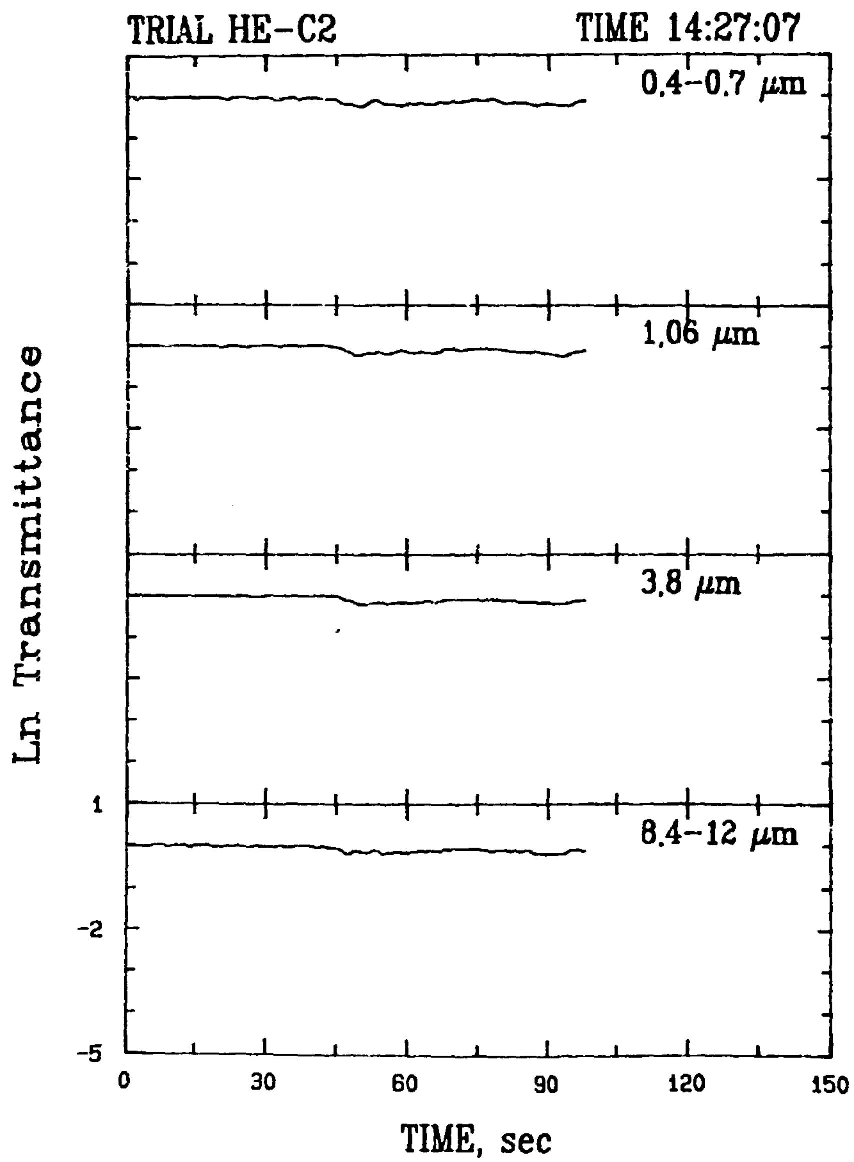
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

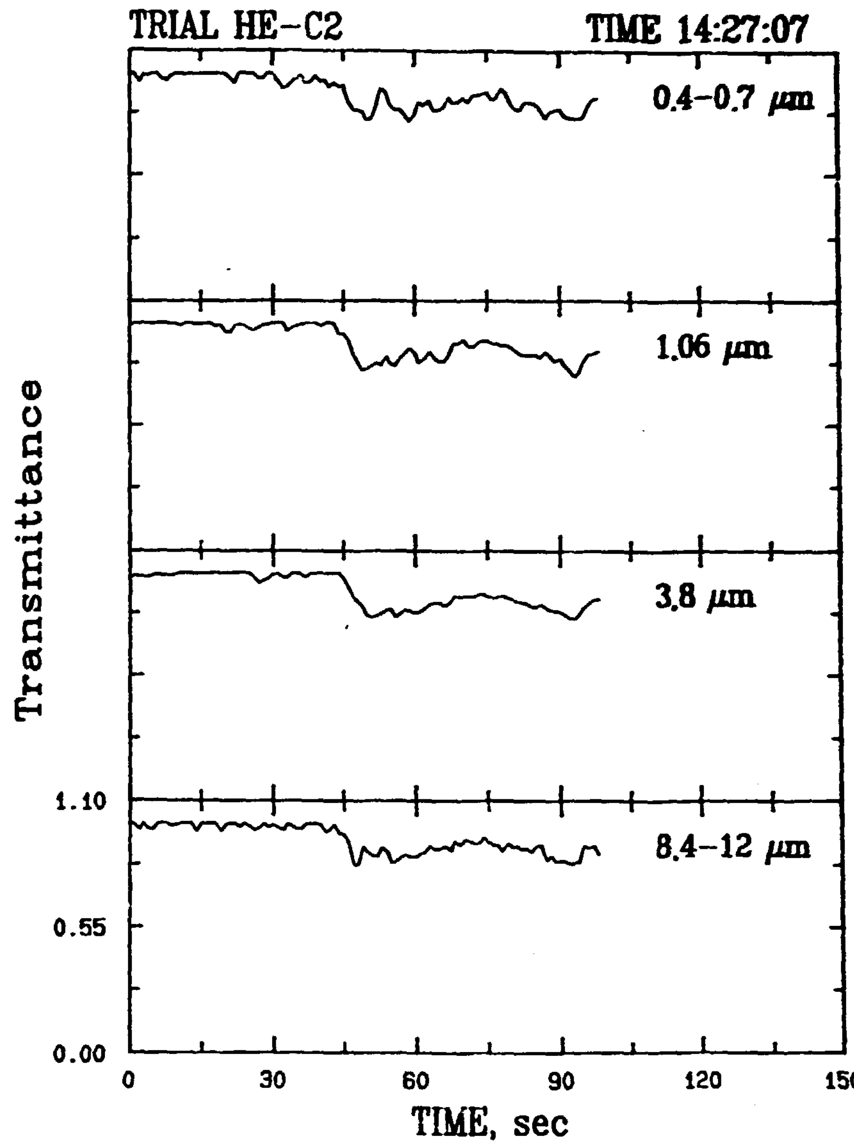


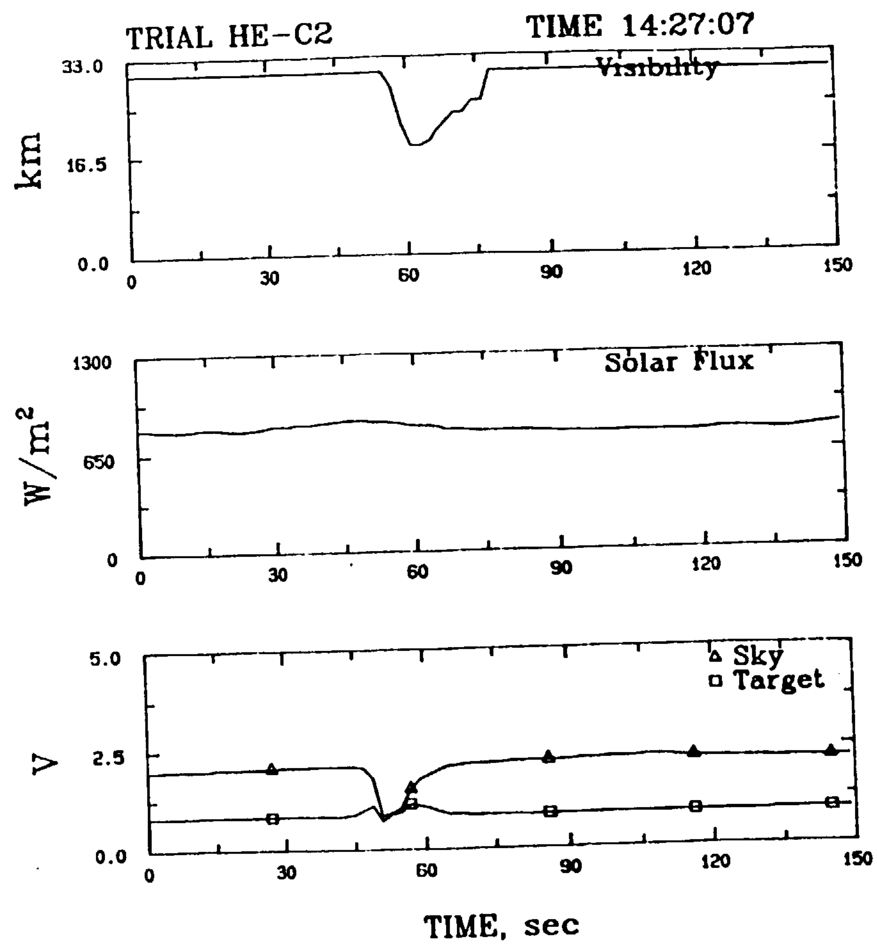
TRIAL HE-C 2
TIME 14:27:44
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



TRIAL HE-C 2
TIME 14:27:44
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
0.50
0.25
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C2
TIME 14:27:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-C2
TIME 14:27:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C2
TIME 14:27:07
Visibility
km
33.0
16.5
0.0
0
30
60
90
120
150
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
TIME, sec

EVENT SUMMARY DATA

Test Number: HEC3

Date: 21 APRIL 83
Detonation Coordinates (M):
X: 80.6
Y: 42.1

Surface Tangent

Charge Shape: BLOCK

Charge Wt: 25.0 LB
Event Time: 15:23:00

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.051

16 Meter Tower (Means)
Start Time: 15:21:37 End Time: 15:25: 1

	2M	4M	6M	16M
Wind Speed (M/S)	5.91	6.64	7.06	7.95
Wind Dir. (DEG)	70.3	67.2	69.8	67.0
Sigma WSP	0.96	1.03	1.12	0.95
Sigma WDIR	6.2	5.5	5.7	5.3
UVW Components				
U (N-S) (M/S)	-1.96	-2.54	-2.41	-3.08
V (E-W) (M/S)	-5.54	-6.10	-6.60	-7.29
W (Vert) (M/S)	0.52	0.09	0.65	•
Sigma U	0.63	0.65	0.72	0.73
Sigma V	0.96	1.02	1.11	0.96
Sigma W	0.21	0.25	0.26	•
Temperature (C)	17.9	17.6	17.4	17.1

Soil Temperature (C): 25.5

Dew Point (C): 0.9

Temperature (C): 17.2

Rel. Hum. (%): 33.2

Abs. Hum. (G/M**3): 4.88

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 195.4

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.16
Target: 0.68

Sky-Target Contrast: -0.41

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	80.0	47.0	25	203	372	567
Post-Shot	80.0	47.0	25	142	205	310

CRATER DATA

Moisture Content: 12.8

CRATER VOLUMES (M**3):
True Crater: 1.139
Apparent Crater: 0.510
Flow: 0.629

DENSITIES (G/CM**3):
Pre-Shot: 1.260
Flow: 1.046
Bottom: 1.016
Side: 1.075

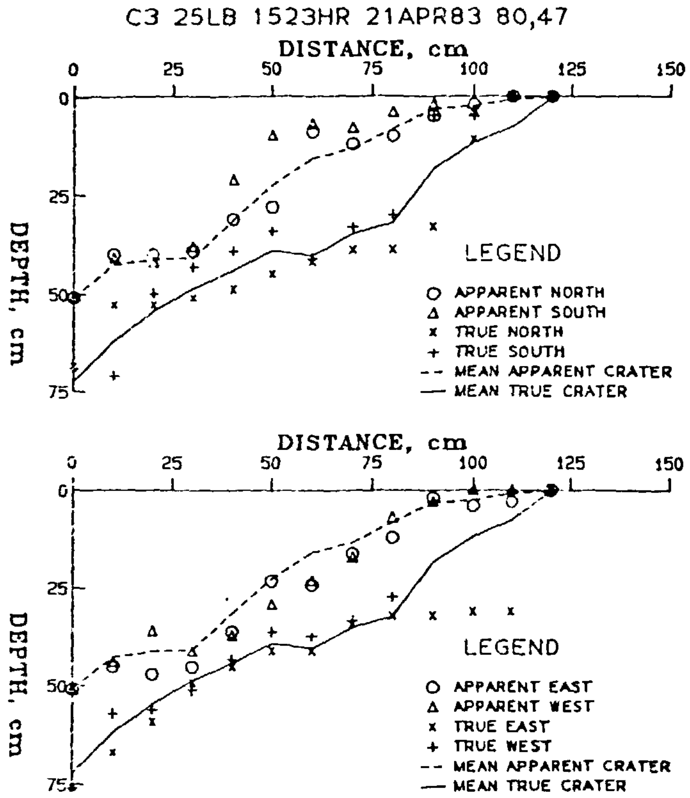
HI VOL DATA (G):

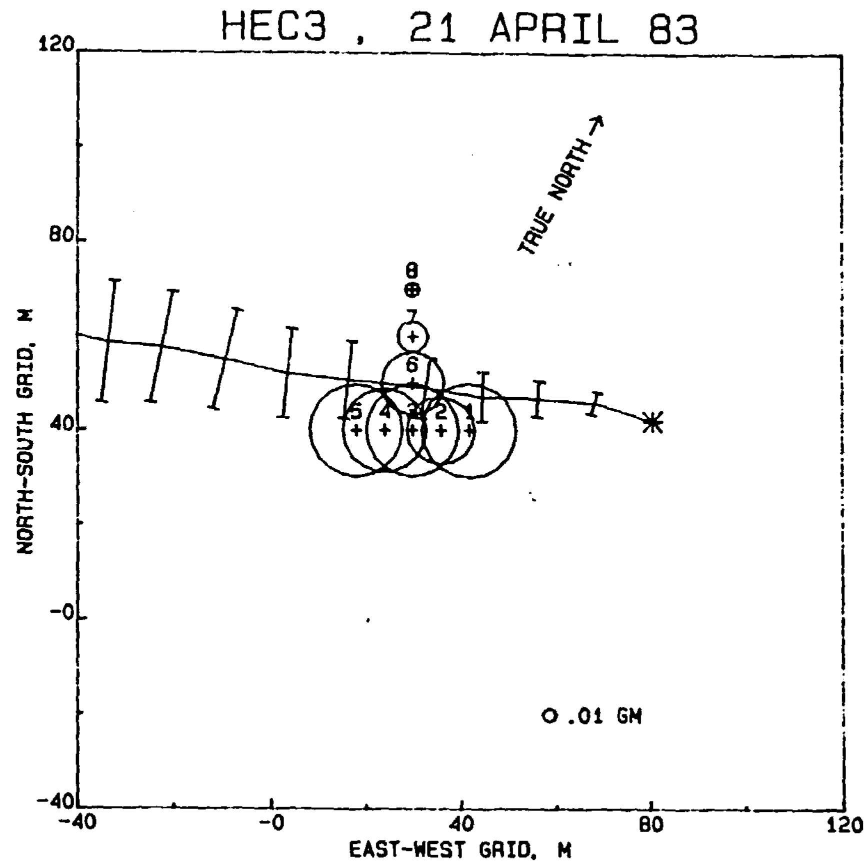
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.5066	0.2522	0.4886	0.3970	0.4908	0.2299	0.0543	0.0122

SUM: 2.4316

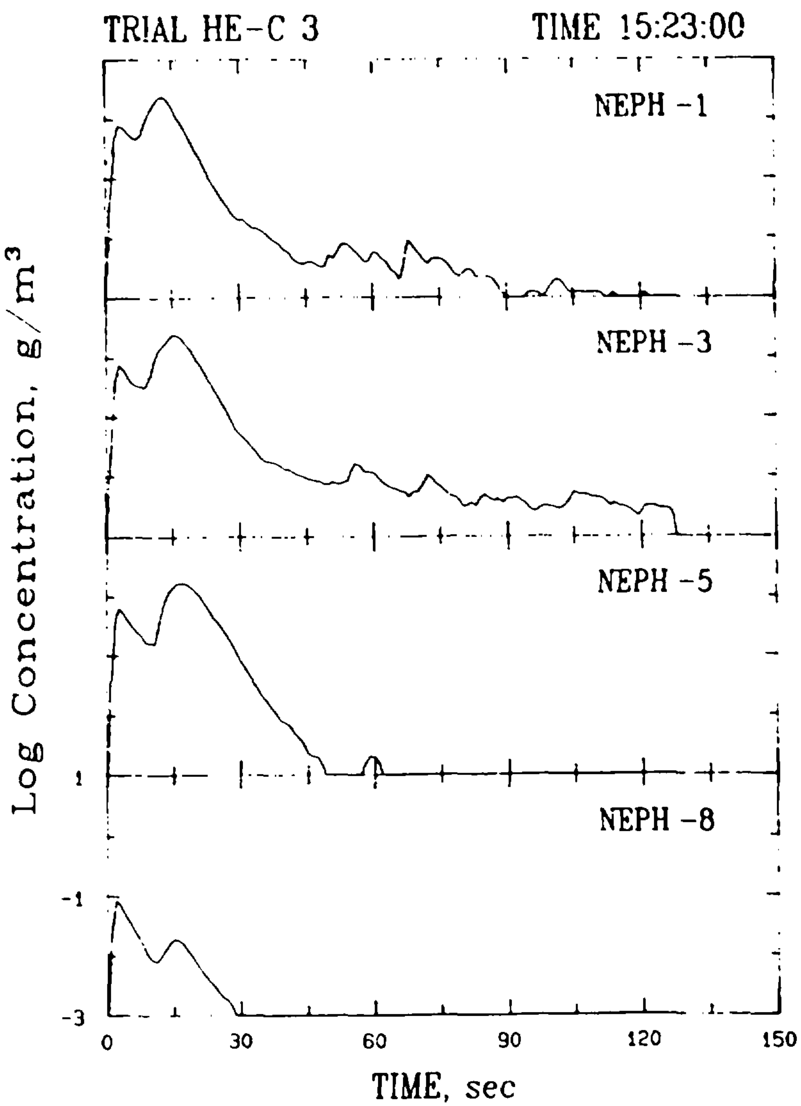
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
10.427	145.600	132.254	47.027

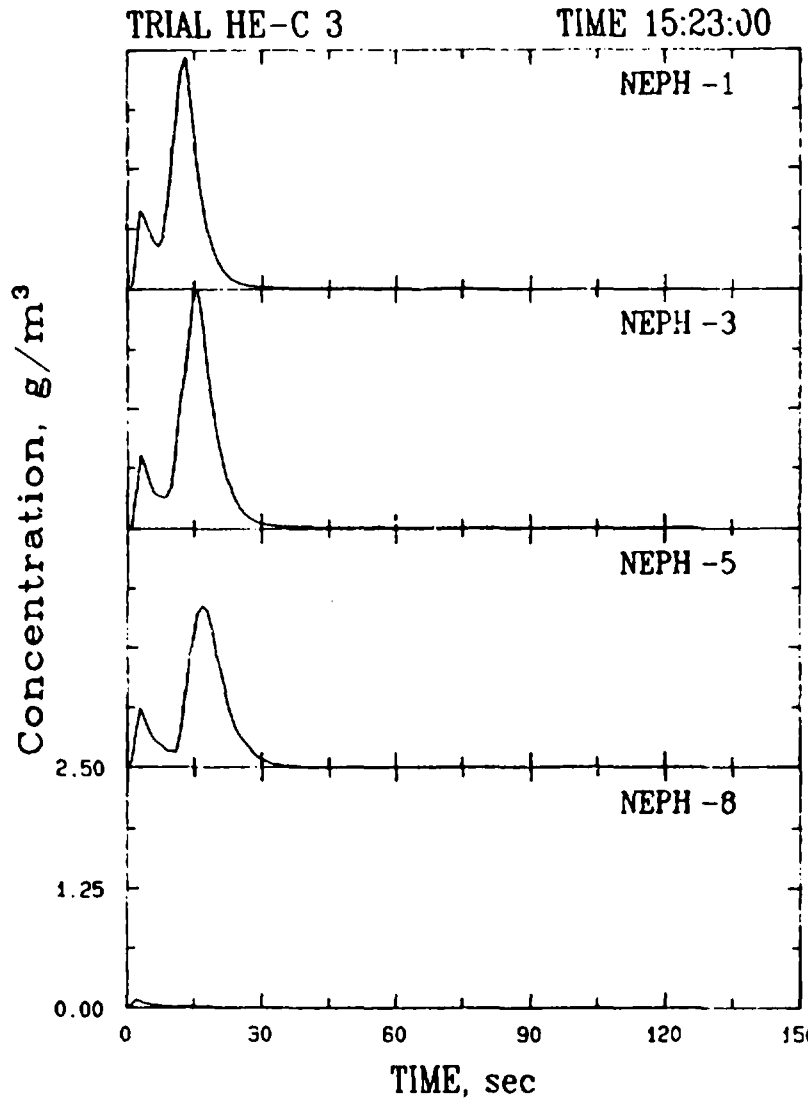




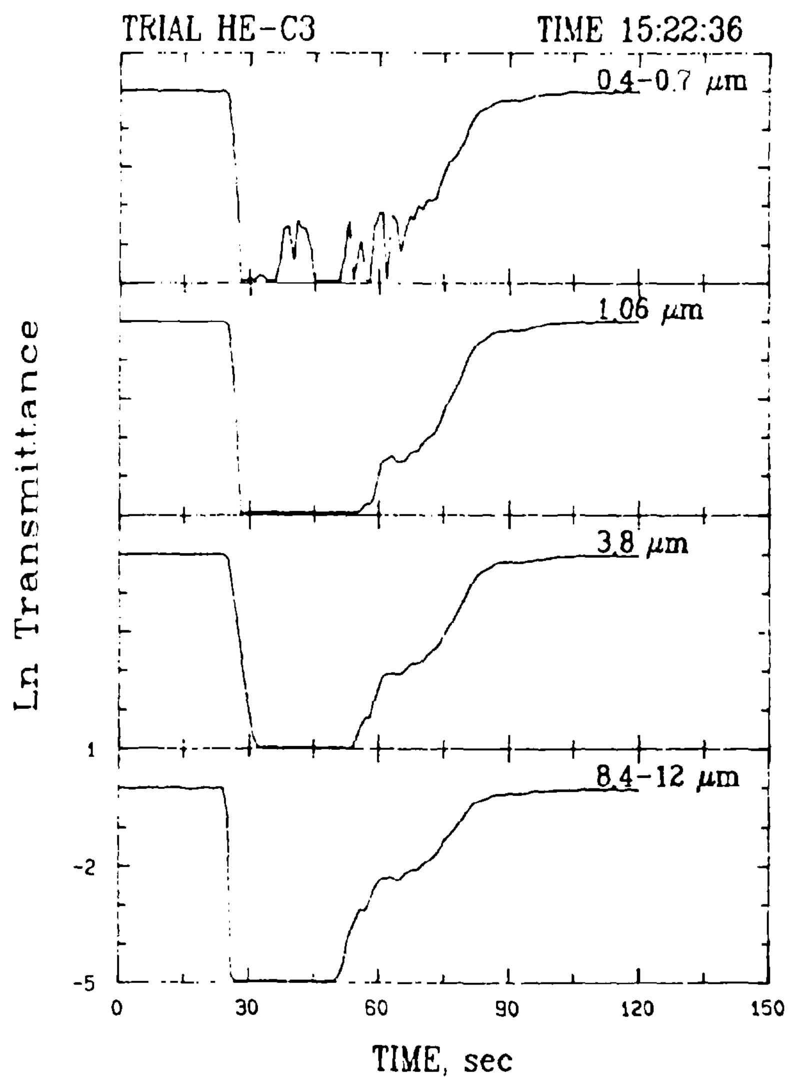
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

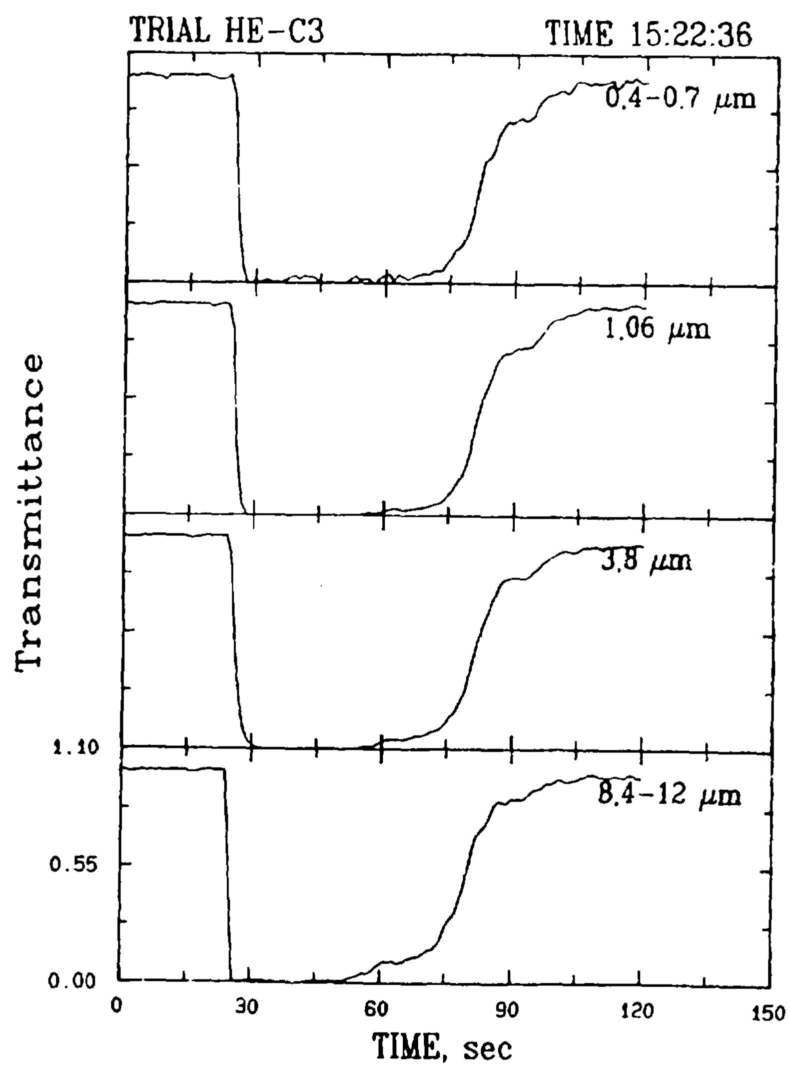


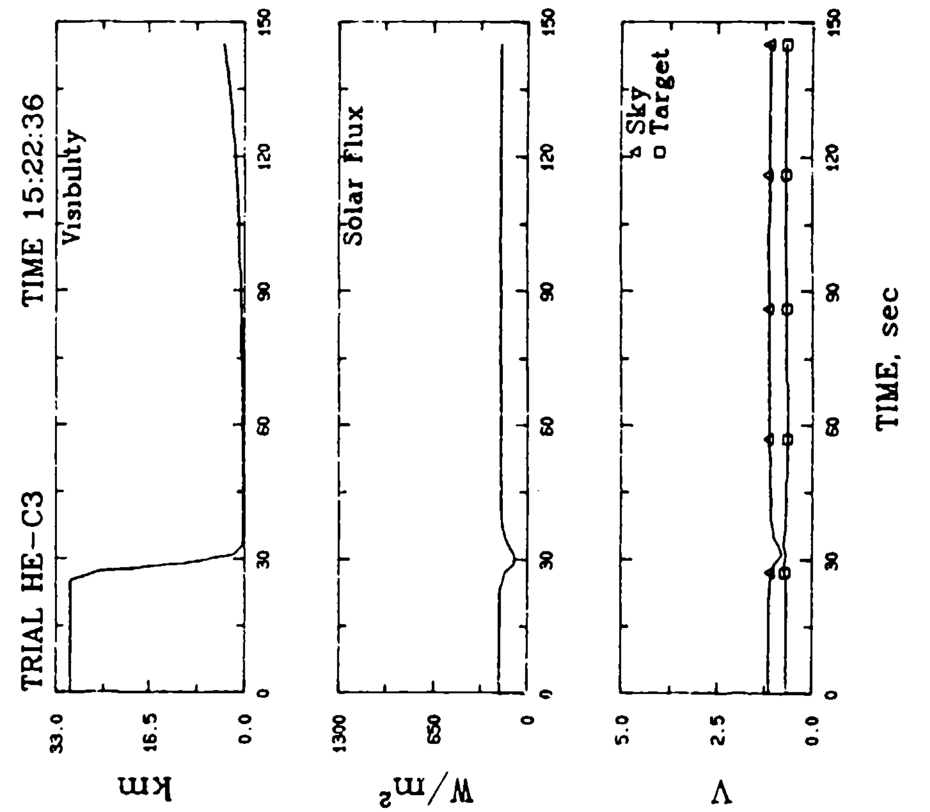
TRIAL HE-C 3
TIME 15:23:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec



TRIAL HE-C 3
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
2.50
1.25
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C3
TIME 15:22:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-C3
TIME 15:22:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C3
TIME 15:22:36
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEC4

Surface Tangent

Date: 22 APRIL 83

Charge Shape: BLOCK

Detonation Coordinates (M):
X: 65.7
Y: 79.3

Charge Wt: 25.0 LB
Event Time: 12:57:01

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.036

16 Meter Tower (Means)
Start Time: 12:55:43 End Time: 12:59: 1

	2M	4M	6M	16M
Wind Speed (M/S)	7.02	8.07	8.06	9.31
Wind Dir. (DEG)	24.9	23.5	25.8	23.0
Sigma WSP	0.99	1.03	1.03	1.14
Sigma WDIR	8.8	8.3	8.8	8.5
UVW Components				
U (N-S) (M/S)	-6.30	-7.35	-7.19	-8.50
V (E-W) (M/S)	-2.89	-3.11	-3.43	-3.55
W (Vert) (M/S)	0.45	-0.05	0.68	•
Sigma U	1.09	1.15	1.16	1.30
Sigma V	0.97	1.07	1.11	1.20
Sigma W	0.23	0.32	0.36	•
Temperature (C)	12.6	12.3	12.1	11.9

Soil Temperature (C): 14.5

Solar Flux (W/M**2): 414.8

Dew Point (C): 1.8

Visual Range (M): 30480.0

Temperature (C): 11.9

Vista Ranger Voltages:
Sky: 1.16
Target: 0.83

Rel. Hum. (%): 50.0

Abs. Hum. (G/M**3): 5.32

Sky-Target Contrast: -0.29

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	65.0 79.0	153	263	463	550
Post-Shot	65.0 79.0	25	70	80	150

CRATER DATA

Moisture Content: 13.5

CRATER VOLUMES (M**3):
True Crater: 0.800
Apparent Crater: 0.310
Flow: 0.490

DENSITIES (G/CM**3):
Pre-Shot: 1.360
Flow: 1.131
Bottom: 1.167
Side: 1.095

HI VOL DATA (G):

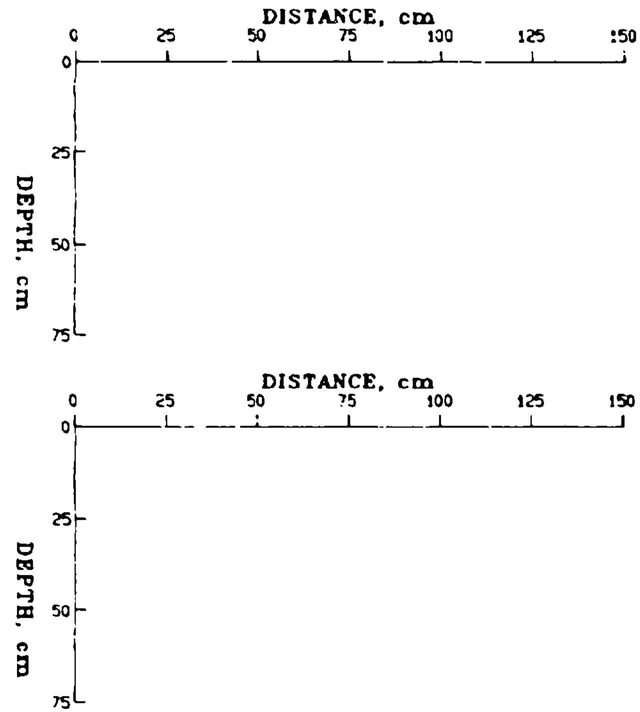
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0057	0.0219	0.2140	0.1715	0.1400	0.2560	0.1866	0.0170

SUM: 1.0127

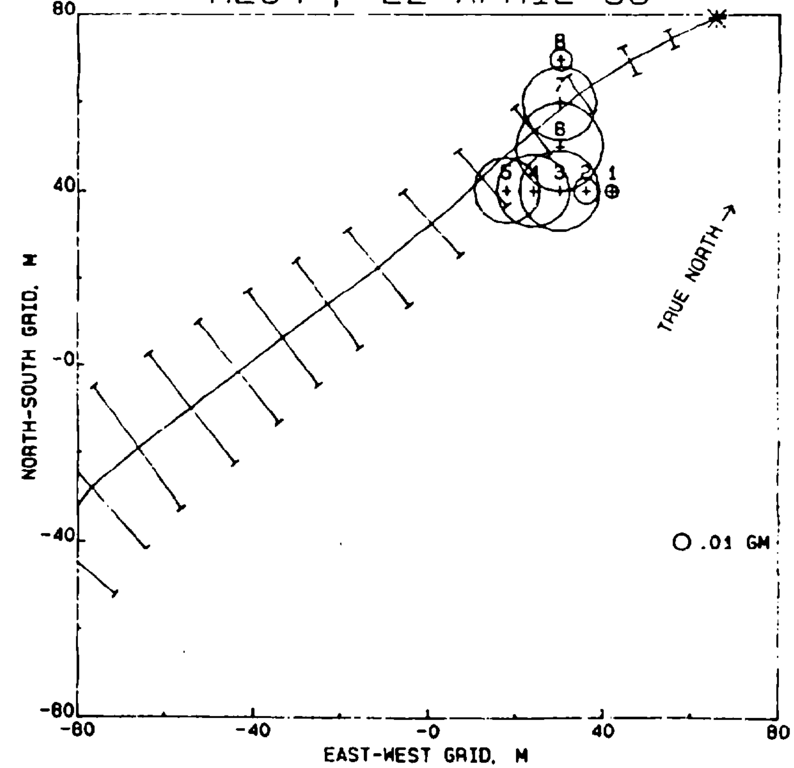
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
19.905	66.400	73.225	137.838

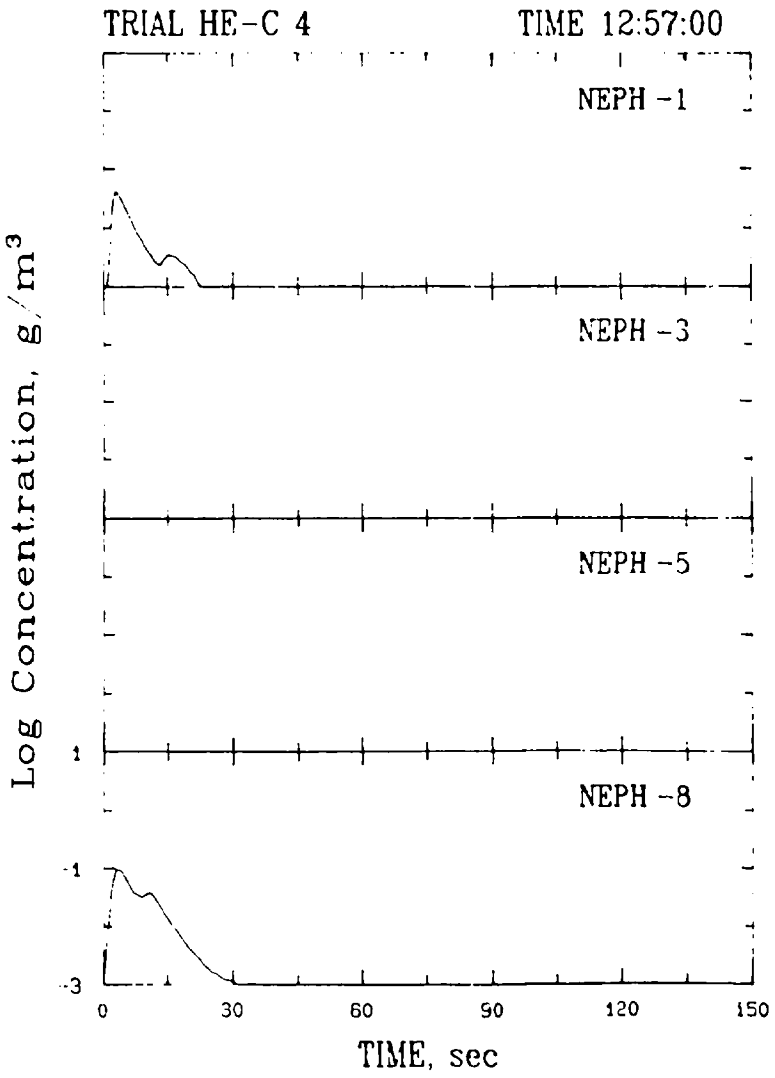
NO DATA FOR C4

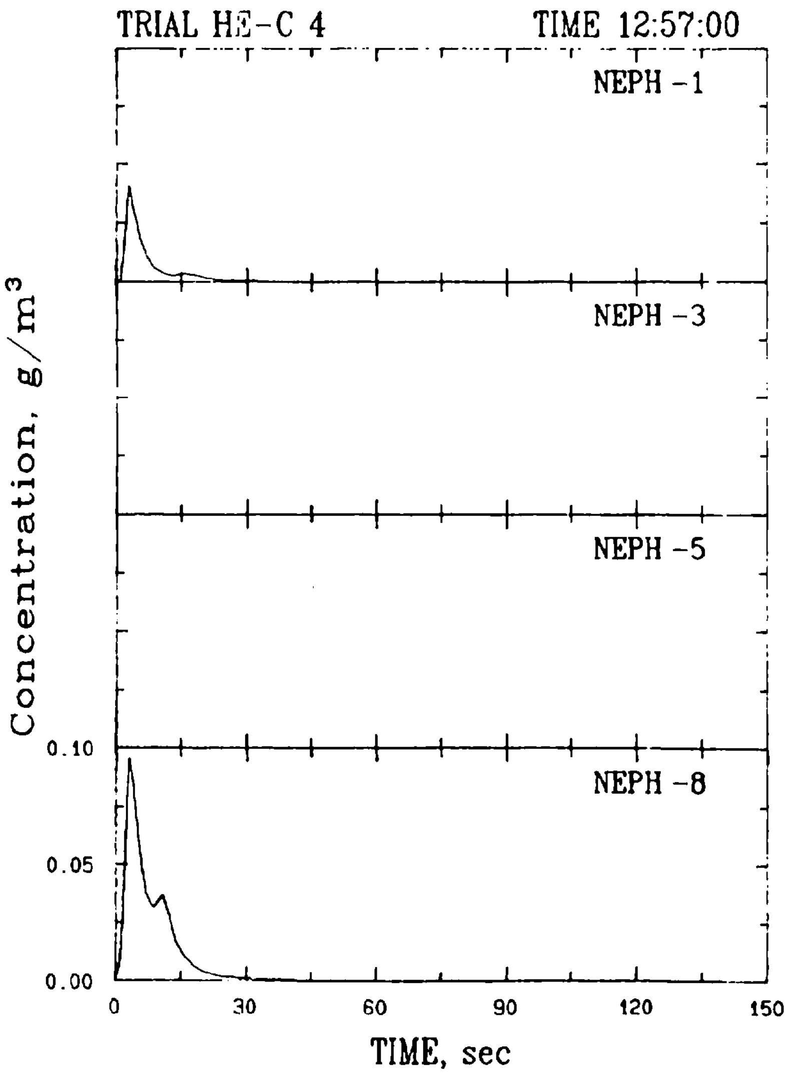


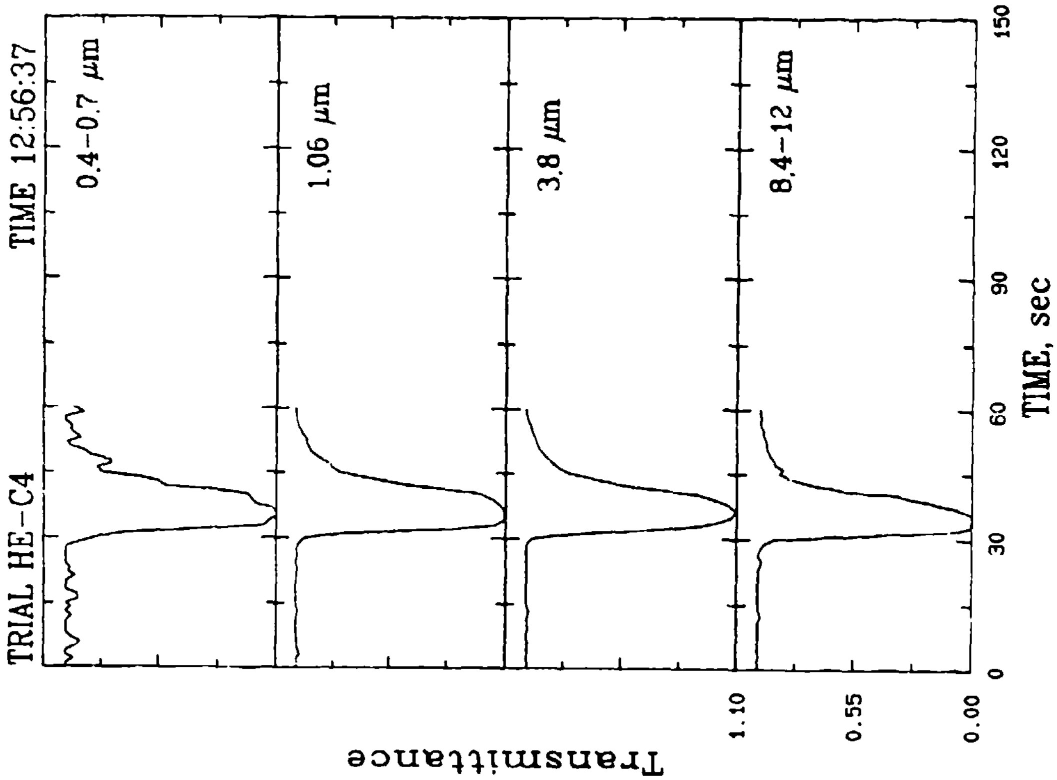
HEC4 , 22 APRIL 83



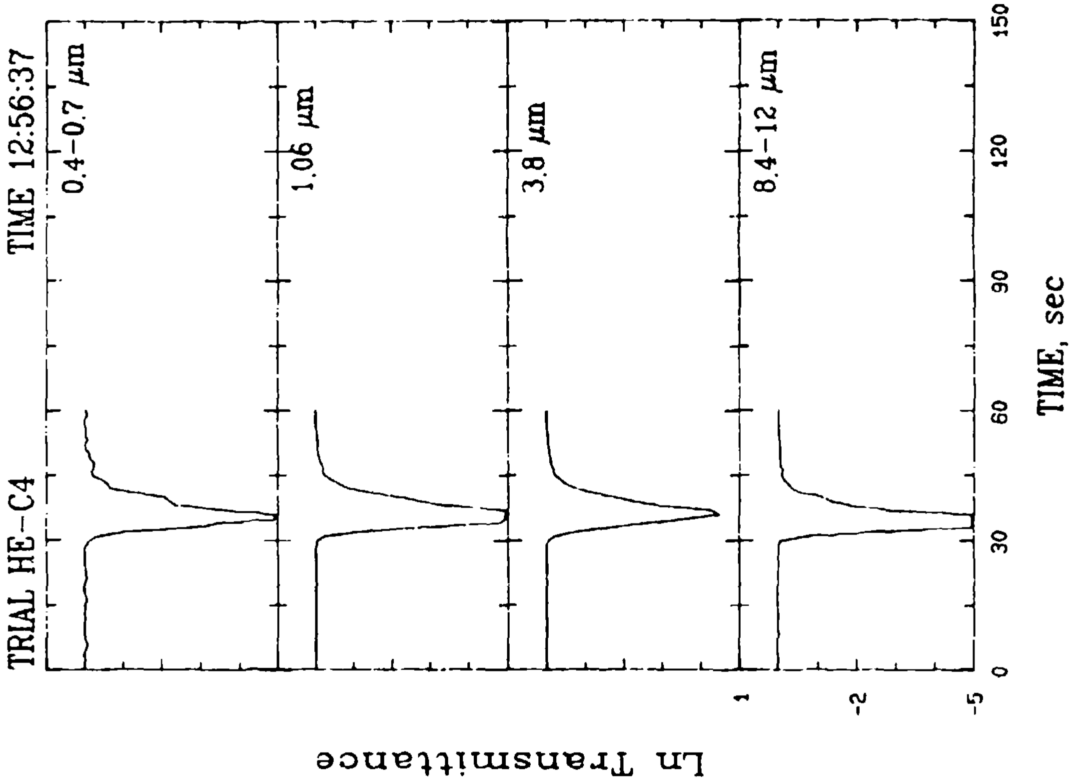
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-C 4
TIME 12:57:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

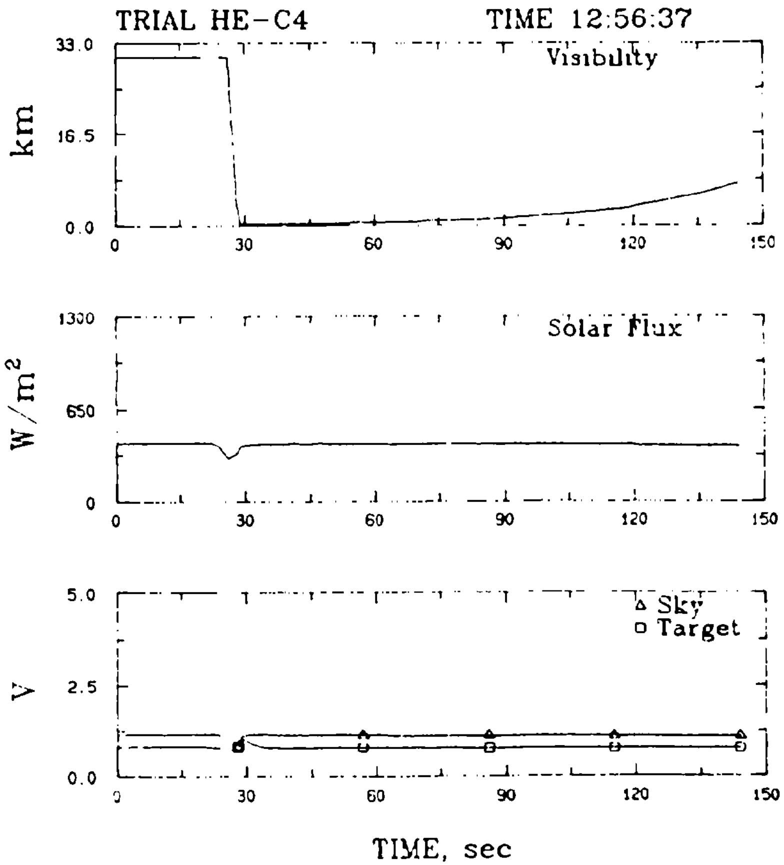

TRIAL HE-C 4
TIME 12:57:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.10
0.05
0.00
0
30
60
90
120
150
TIME, sec

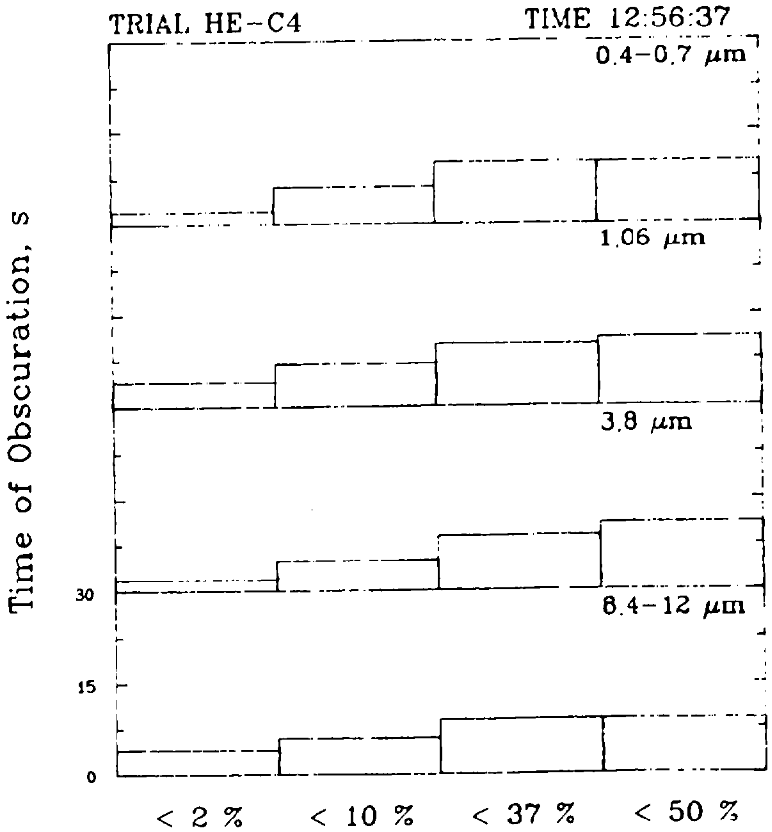


TRIAL HE-C4
TIME 12:56:37
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C4
TIME 12:56:37
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-C4
TIME 12:56:37
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Δ Sky
□ Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec


TRIAL HE-C4
TIME 12:56:37
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC5

Surface Tangent

Date: 22 APRIL 83

Charge Shape: BLOCK

Detonation Coordinates (M):
X: 90.6
Y: 71.0

Charge Wt: 25.0 LB
Event Time: 14:17:00

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.111

16 Meter Tower (Means)
Start Time: 14:15:50 End Time: 14:19:15

	2M	4M	6M	16M
Wind Speed (M/S)	8.82	9.83	10.21	11.54
Wind Dir. (DEG)	52.4	49.0	52.8	47.7
Sigma WSP	1.51	1.55	1.47	1.26
Sigma WDIR	8.3	7.9	7.7	7.4
UVW Components				
U (N-S) (M/S)	-5.34	-6.40	-6.13	-7.73
V (E-W) (M/S)	-6.91	-7.33	-8.06	-8.44
W (Vert) (M/S)	0.77	0.14	1.04	*
Sigma U	1.43	1.54	1.42	1.54
Sigma V	1.36	1.39	1.42	1.21
Sigma W	0.28	0.38	0.43	*
Temperature (C)	13.5	12.8	12.6	11.7

Soil Temperature (C): 20.5

Solar Flux (W/M**2): 870.6

Dew Point (C): 2.5

Visual Range (M): 30480.0

Temperature (C): 13.2

Vista Ranger Voltages:
Sky: 0.74
Target: 0.61

Rel. Hum. (%): 48.3

Abs. Hum. (G/M**3): 5.56

Sky-Target Contrast: -0.17

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	91.0 71.0	25	130	170	*
Post-Shot	91.0 71.0	*	*	*	*

CRATER DATA

Moisture Content: 12.7

CRATER VOLUMES (M**3):
True Crater: 1.300
Apparent Crater: 0.560
Flow: 0.740

DENSITIES (G/CM**3):
Pre-Shot: 1.230
Flow: 1.123
Bottom: 1.196
Side: 1.051

HI VOL DATA (G):

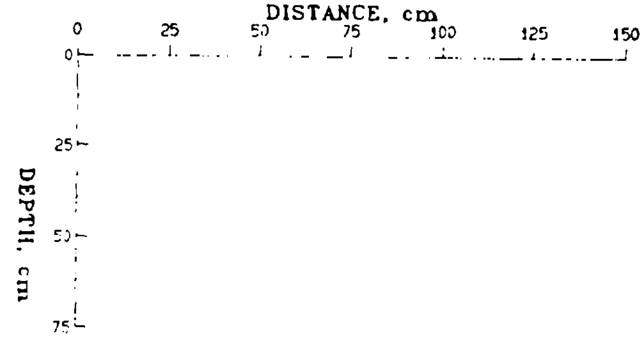
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0074	0.0111	0.0323	0.0952	0.1109	0.1832	0.2767	0.1463

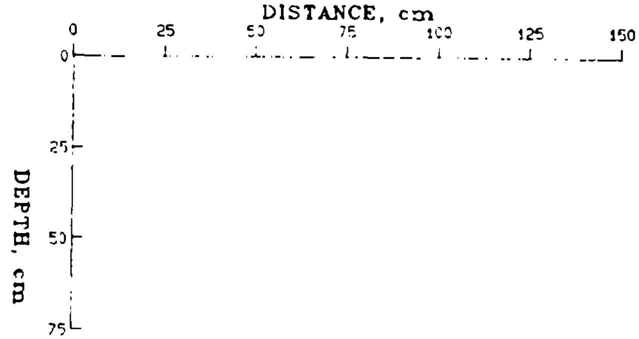
SUM: 0.8631

GELMAN DOSAGE (G S/M**3):

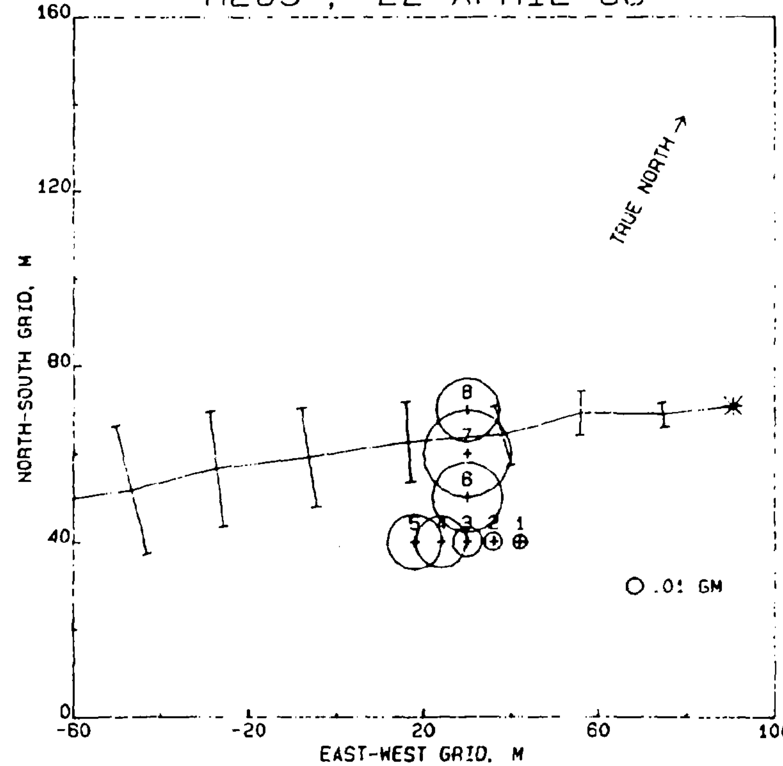
GELMAN A	GELMAN B	GELMAN C	GELMAN D
18.009	36.000	58.281	55.676

NO DATA FOR C5

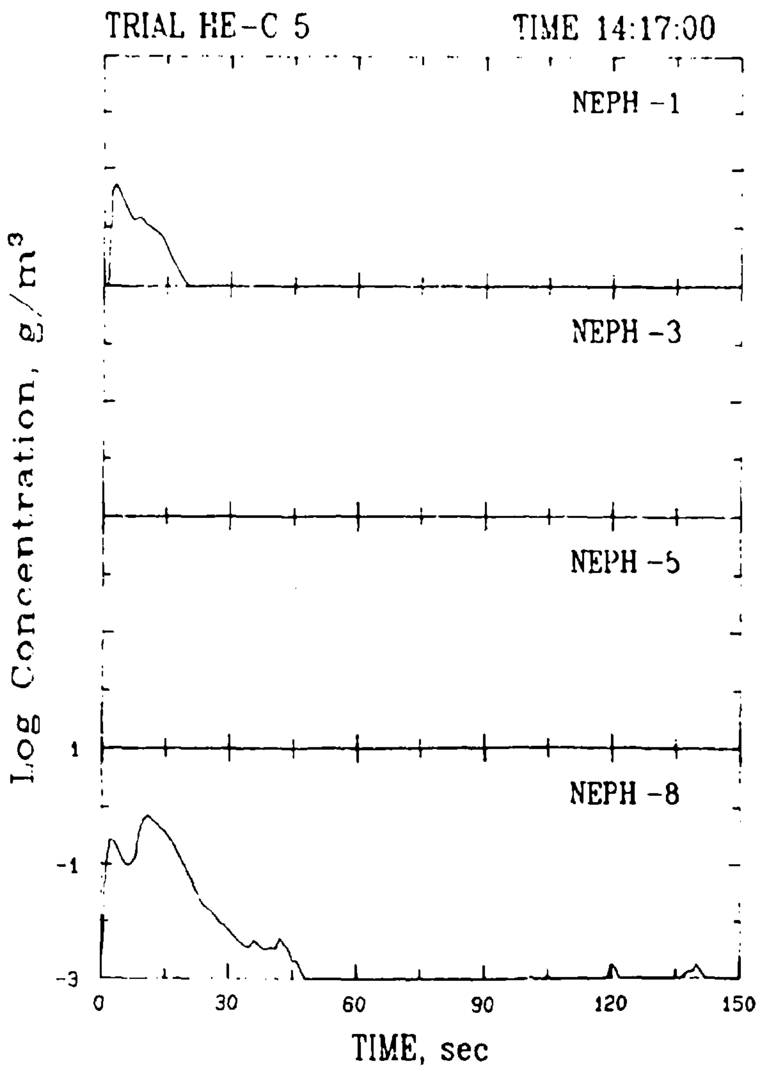


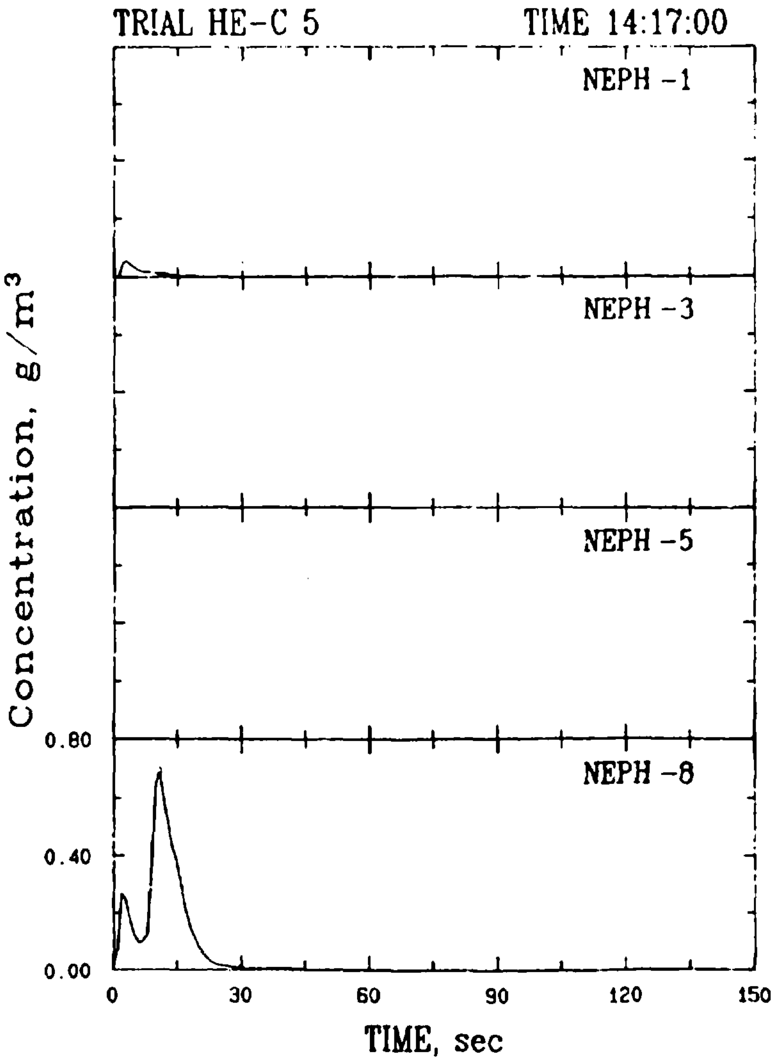


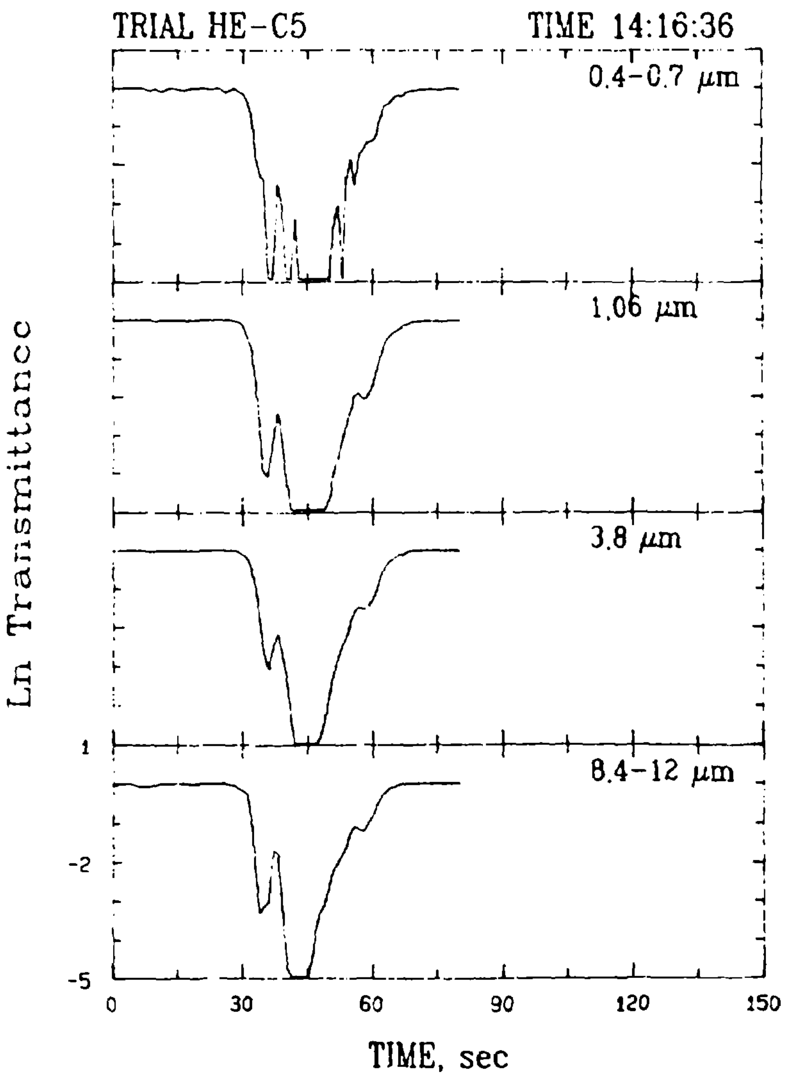
HEC5 , 22 APRIL 83



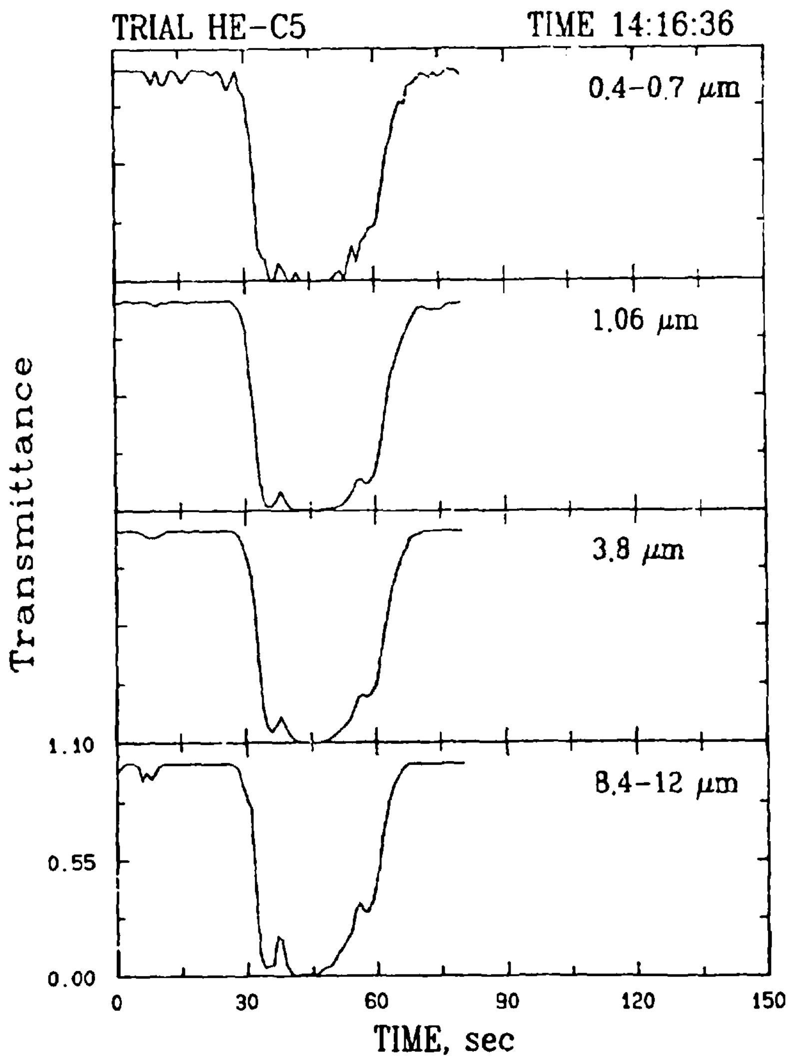
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-C 5
TIME 14:17:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

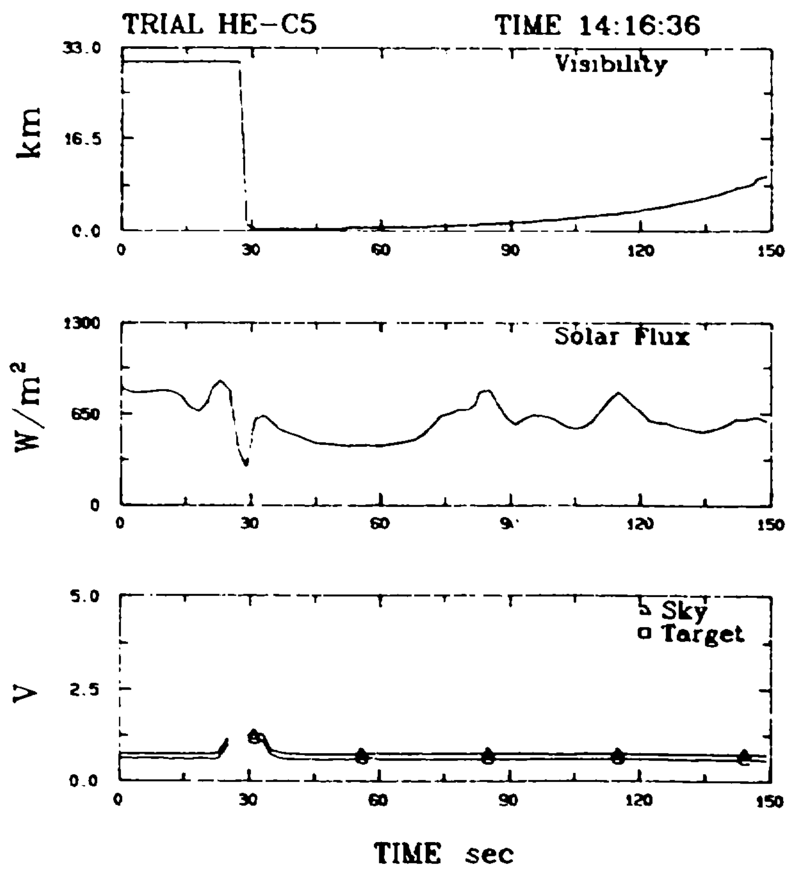

TRIAL HE-C 5
TIME 14:17:00
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.80
0.40
0.00
0
30
60
90
120
150
TIME, sec



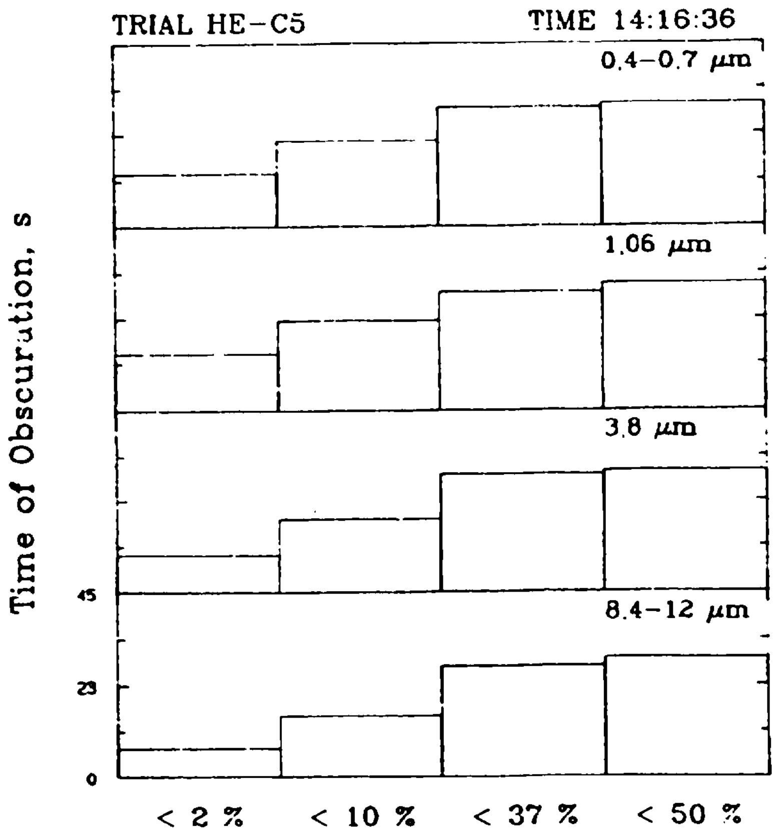
TRIAL HE-C5
TIME 14:16:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-C5
TIME 14:16:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C5
TIME 14:16:36
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME sec



TRIAL HE-C5
TIME 14:16:36
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
45
23
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC6

Date: 23 APRIL 83

Detonation Coordinates (M):

X: 29.8

Y: 5.6

Surface Tangent

Charge Shape: BLOCK

Charge Wt: 25.0 LB

Event Time: 10:22:16

METEOROLOGICAL DATA:

Pasquill Category: B

Richardson Number: -0.194

16 Meter Tower (Means)

Start Time: 10:18:57 End Time: 10:24:13

	2M	4M	6M	16M
Wind Speed (M/S)	3.50	3.80	3.92	4.46
Wind Dir. (DEG)	156.6	156.1	156.2	152.8
Sigma WSP	1.45	1.51	1.51	1.59
Sigma WDIR	22.0	20.8	20.7	14.8
UVW Components				
U (N-S) (M/S)	2.98	3.25	3.34	3.83
V (E-W) (M/S)	-1.39	-1.53	-1.60	-2.04
W (Vert) (M/S)	0.11	0.27	0.05	*
Sigma U	1.38	1.45	1.42	1.48
Sigma V	1.28	1.31	1.38	1.19
Sigma W	0.24	0.35	0.40	*
Temperature (C)	13.5	12.6	12.2	11.8

Soil Temperature (C): 23.9

Dew Point (C): 3.1

Temperature (C): 12.1

Rel. Hum. (%): 54.4

Abs. Hum. (G/M**3): 5.84

Rain Accumulation (MM): 0.00

Solar Flux (W/M**2): 353.4

Visual Range (M): 30480.0

Vista Ranger Voltages:
Sky: 1.26
Target: 1.17

Sky-Target Contrast: -0.07

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	29.8	5.5	67	190	327	540
Post-Shot	29.8	5.5	25	83	395	550

CRATER DATA

Moisture Content: 13.9

CRATER VOLUMES (M**3):
True Crater: 1.284
Apparent Crater: 0.484
Flow: 0.800

DENSITIES (G/CM**3):
Pre-Shot: 1.340
Flow: 1.137
Bottom: 1.163
Side: 1.111

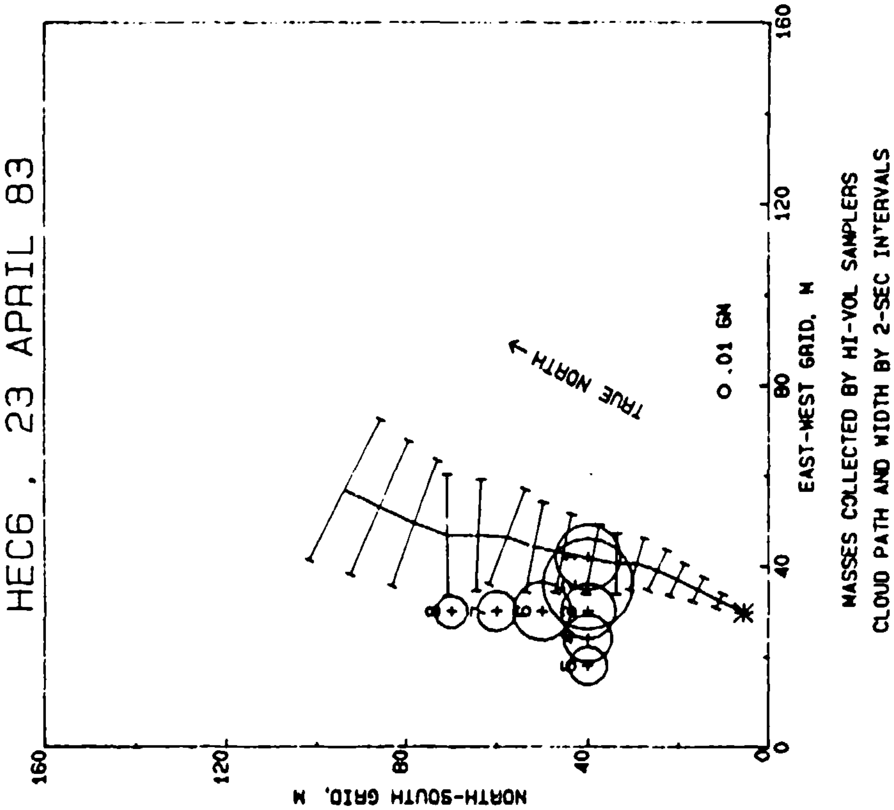
HI VOL DATA (G):

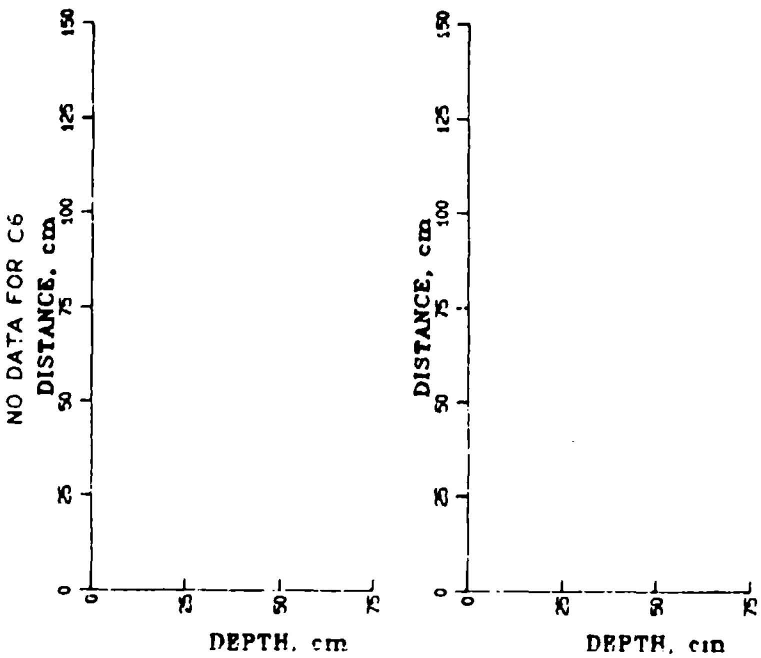
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.2544	0.5555	0.2016	0.1612	0.1004	0.2292	0.1089	0.0691

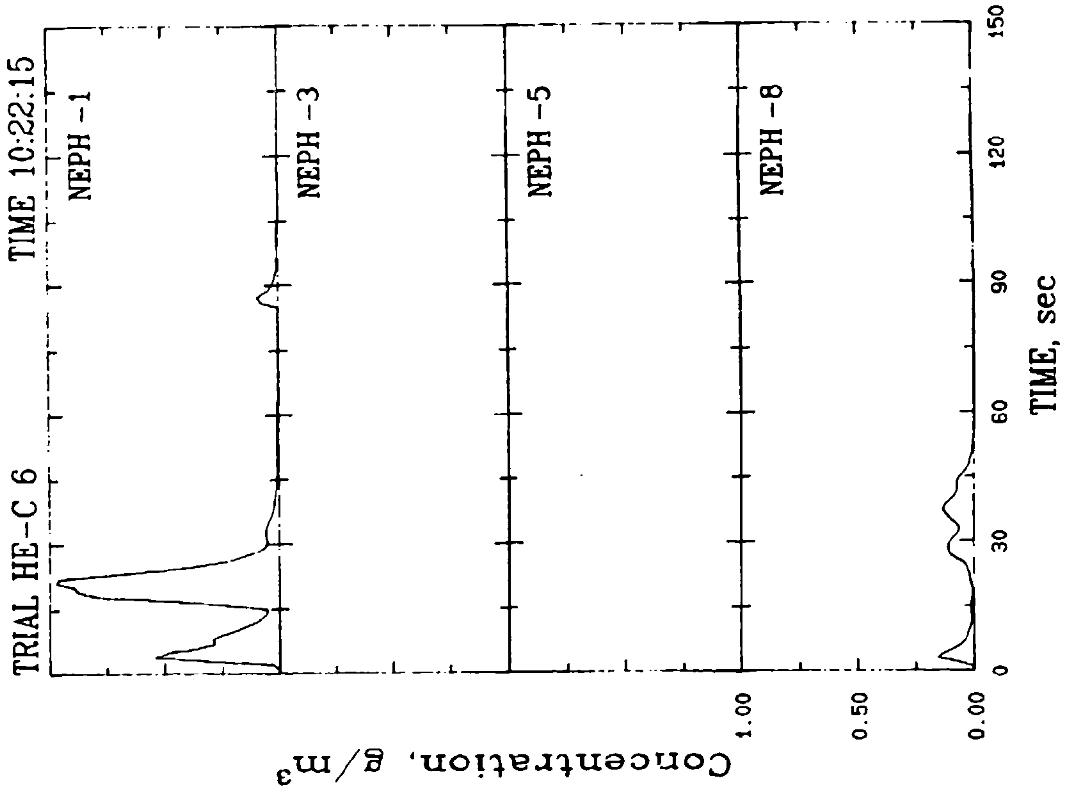
SUM: 1.7203

GELMAN DOSAGE (G S/M**3):

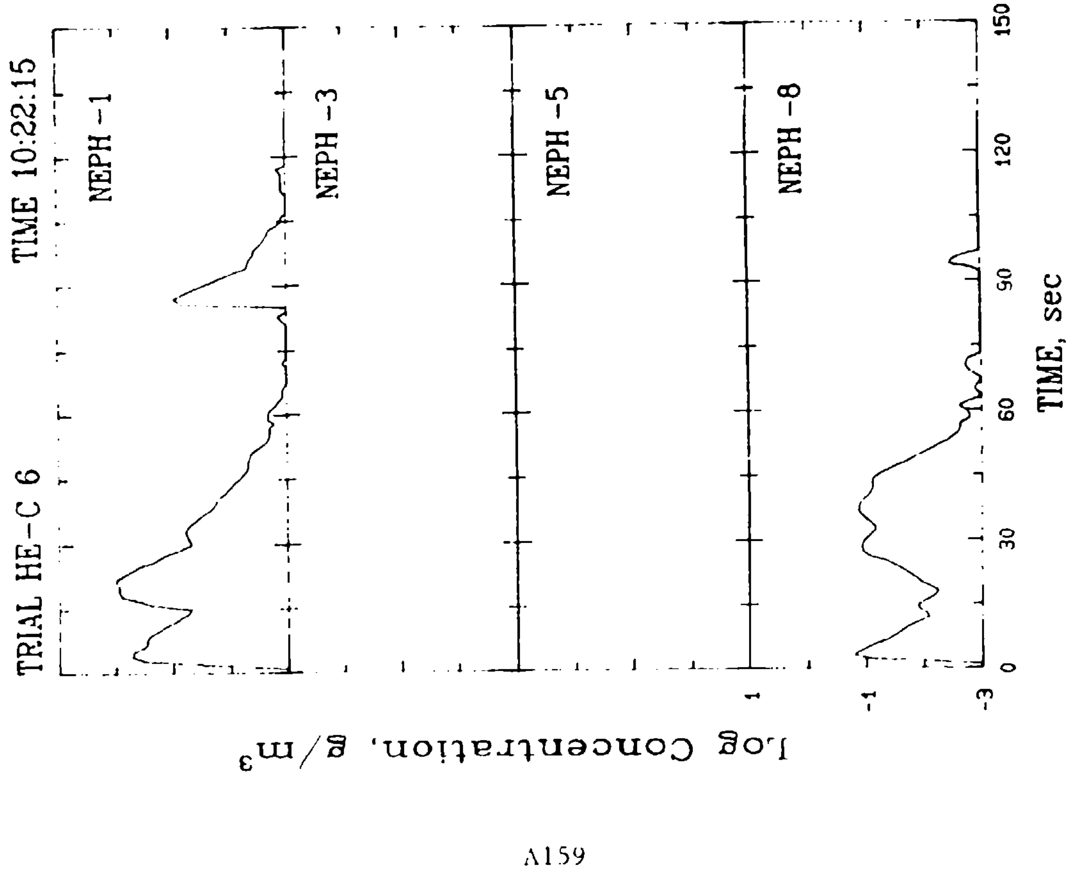
GELMAN A	GELMAN B	GELMAN C	GELMAN D
59.716	93.600	71.731	75.676


HEC6 . 23 APRIL 83
TRUE NORTH
O .01 GM
EAST-WEST GRID, M
NORTH-SOUTH GRID, M
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

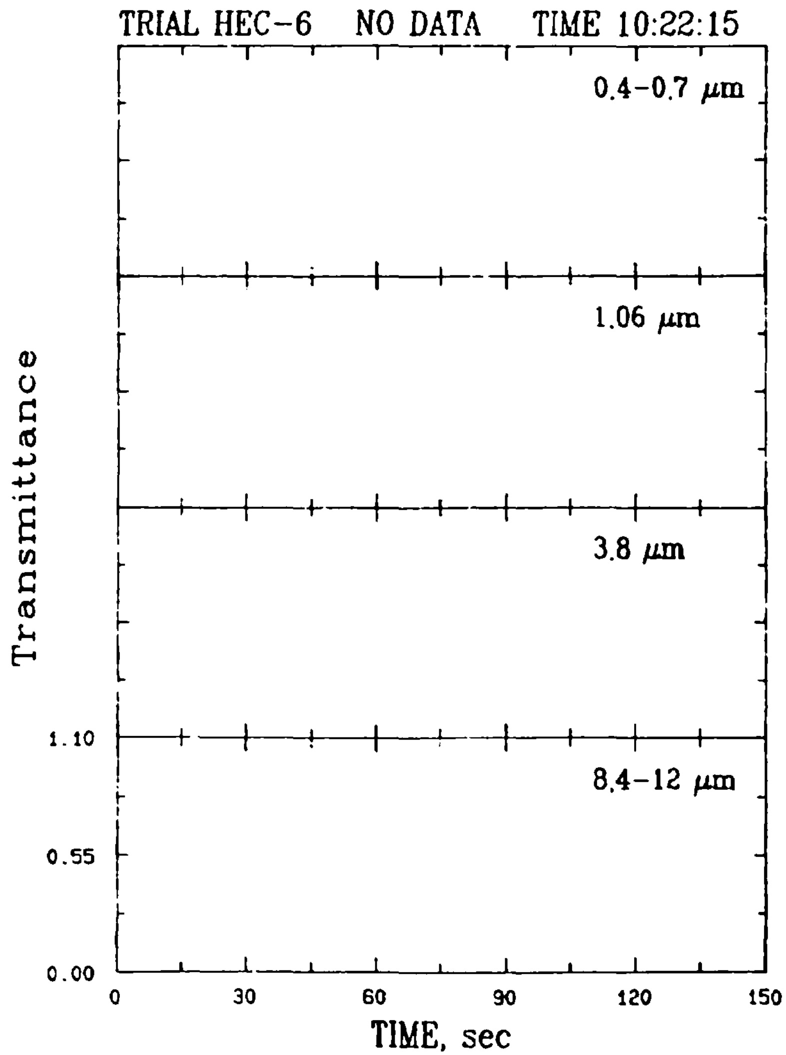

NO DATA FOR C6
DISTANCE, cm
DEPTH, cm
DISTANCE, cm
DEPTH, cm



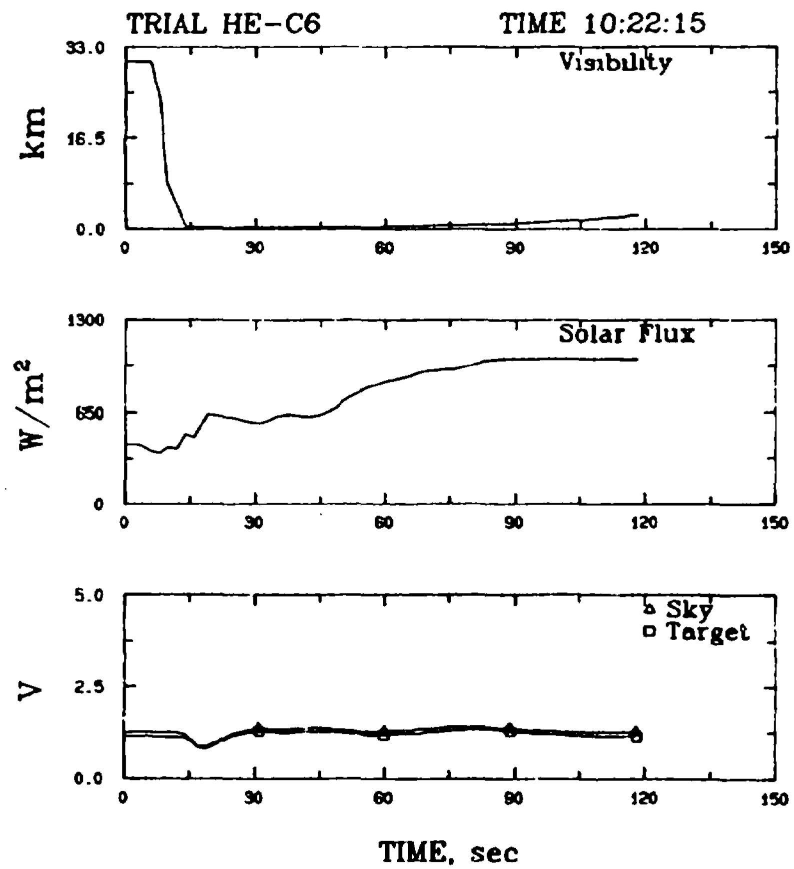
TRIAL HE-C 6
TIME 10:22:15
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
1.00
0.50
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C 6
TIME 10:22:15
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec



TRIAL HEC-6 NO DATA TIME 10:22:15
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C6 TIME 10:22:15
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec

EVENT SUMMARY DATA

Test Number: HEC7

Surface Tangent

Date: 23 APRIL 83

Detonation Coordinates (M):
X: 57.2
Y: 3.1

Charge Shape: BLOCK

Charge Wt: 25.0 LB
Event Time: 12:37:11

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.235

16 Meter Tower (Means)
Start Time: 12:35:58 End Time: 12:39:24

	2M	4M	6M	16M
Wind Speed (M/S)	5.32	5.63	5.95	6.78
Wind Dir. (DEG)	117.3	117.5	118.8	119.2
Sigma WSP	1.01	1.07	1.19	1.14
Sigma WDIR	14.3	13.8	12.2	10.8
UVW Components				
U (N-S) (M/S)	2.35	2.52	2.78	3.16
V (E-W) (M/S)	-4.59	-4.86	-5.11	-5.86
W (Vert) (M/S)	0.40	0.44	0.39	•
Sigma U	1.18	1.22	1.14	1.02
Sigma V	1.14	1.19	1.30	1.37
Sigma W	0.26	0.35	0.37	•
Temperature (C)	15.0	14.3	13.9	13.5

Soil Temperature (C): 27.2

Solar Flux (W/M**2): 367.9

Dew Point (C): 3.1

Visual Range (M): 30480.0

Temperature (C): 14.2

Vista Ranger Voltages:
Sky: 1.27
Target: 1.10

Rel. Hum. (%): 47.2

Abs. Hum. (G/M**3): 5.77

Sky-Target Contrast: -0.14

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)		SFC	15	30	45
Pre-Shot	57.0	3.0	50	240	350	465
Post-Shot	57.0	3.0	•	•	•	•

CRATER DATA

Moisture Content: 11.6

CRATER VOLUMES (M**3):
True Crater: 1.862
Apparent Crater: 0.392
Flow: 1.470

DENSITIES (G/CM**3):
Pre-Shot: 1.310
Flow: 1.101
Bottom: 1.140
Side: 1.062

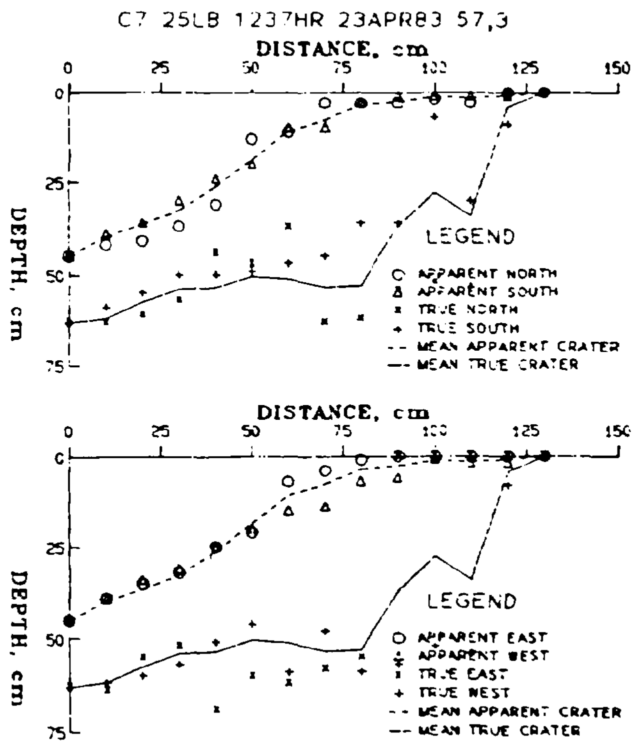
HI VOL DATA (G):

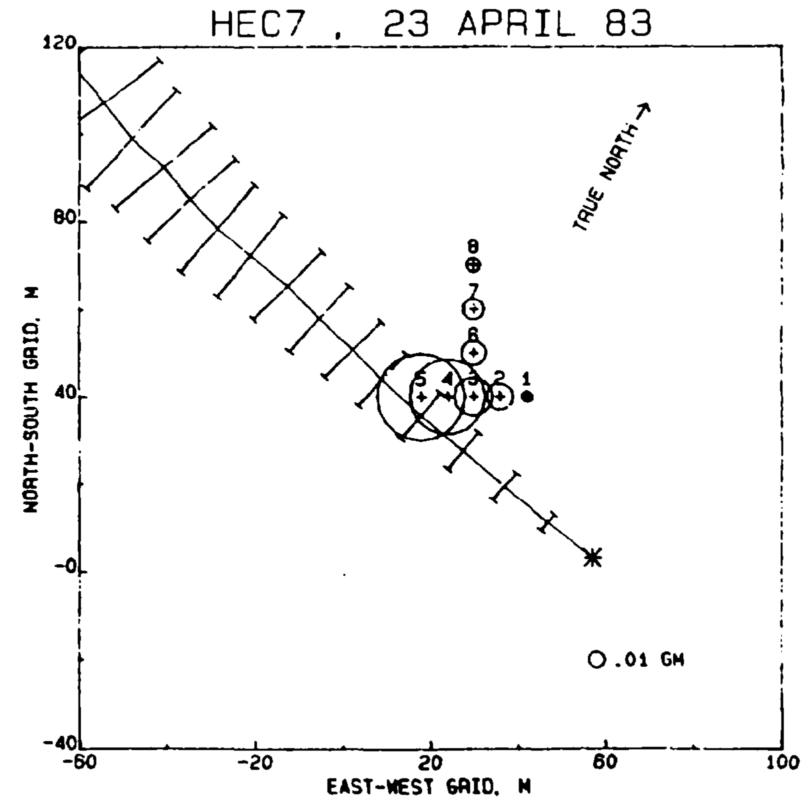
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0048	0.0248	0.0531	0.2121	0.2838	0.0241	0.0163	0.0071

SUM: 0.6261

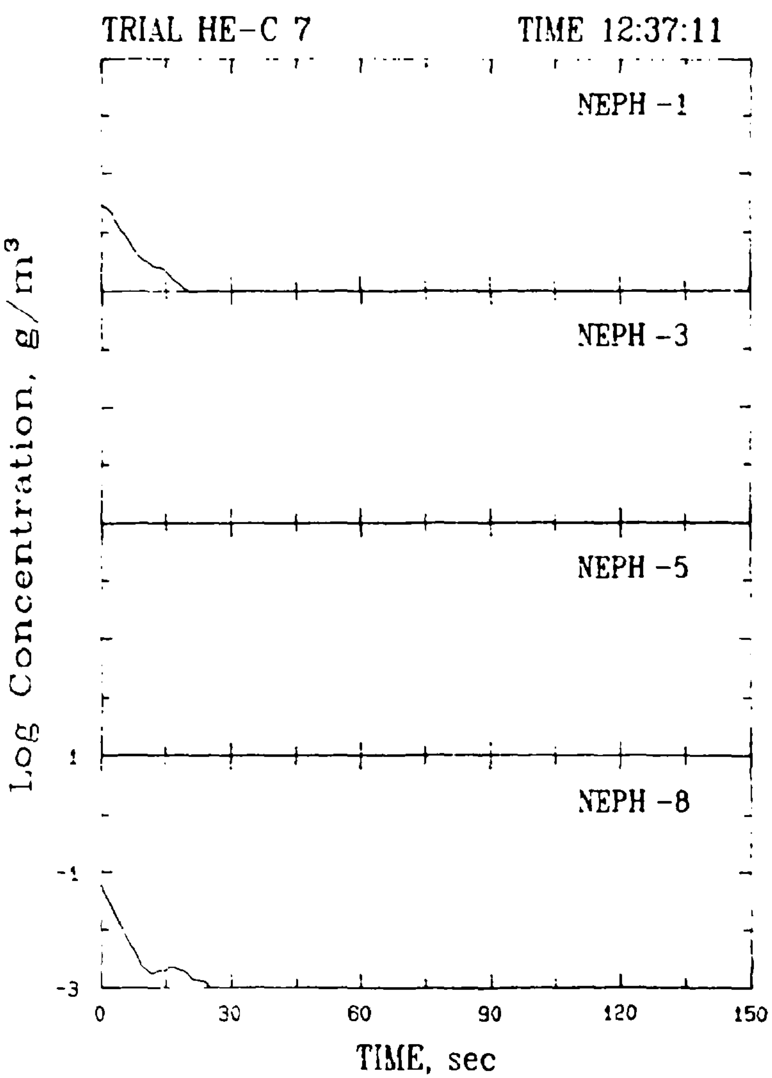
GELMAN DOSAGE (G S/M**3):

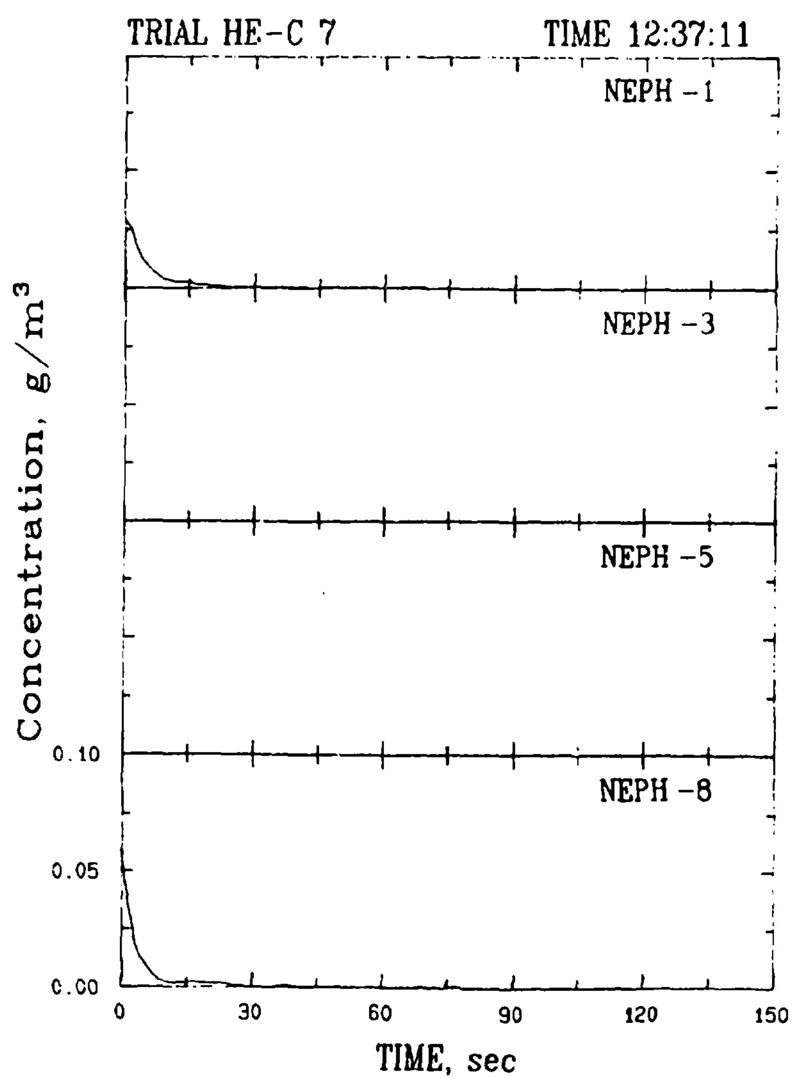
GELMAN A	GELMAN B	GELMAN C	GELMAN D
0.000	0.000	0.000	0.000

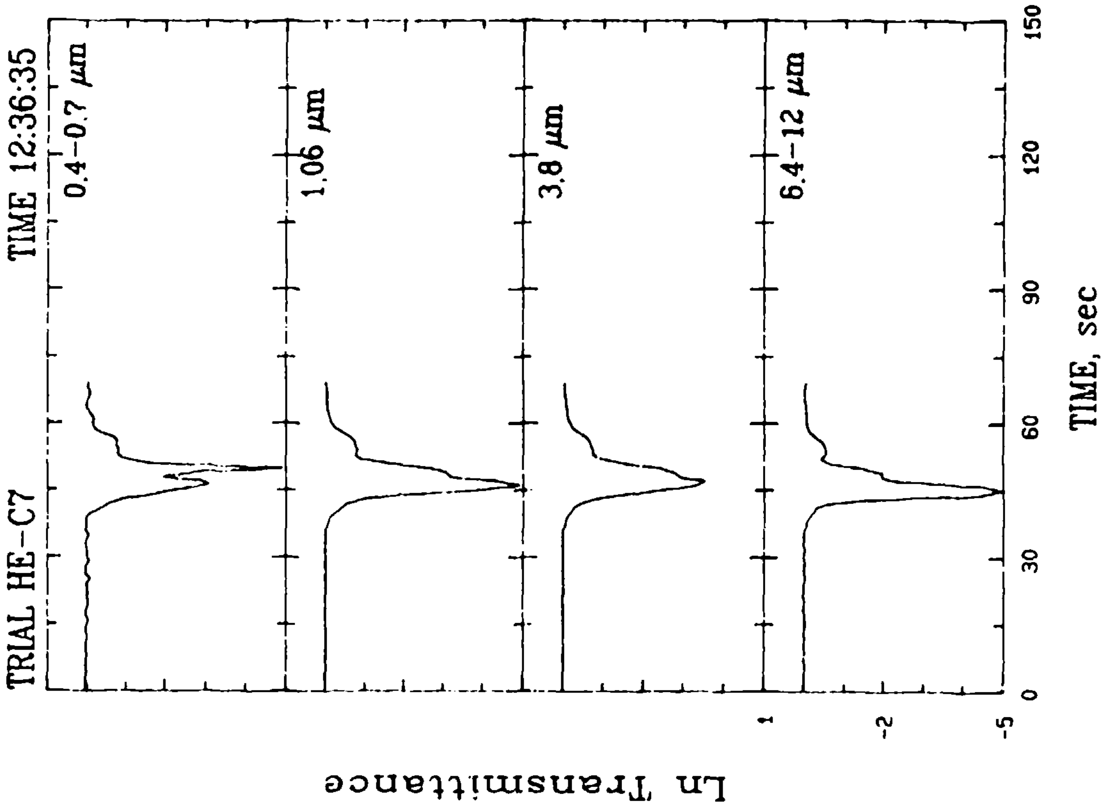




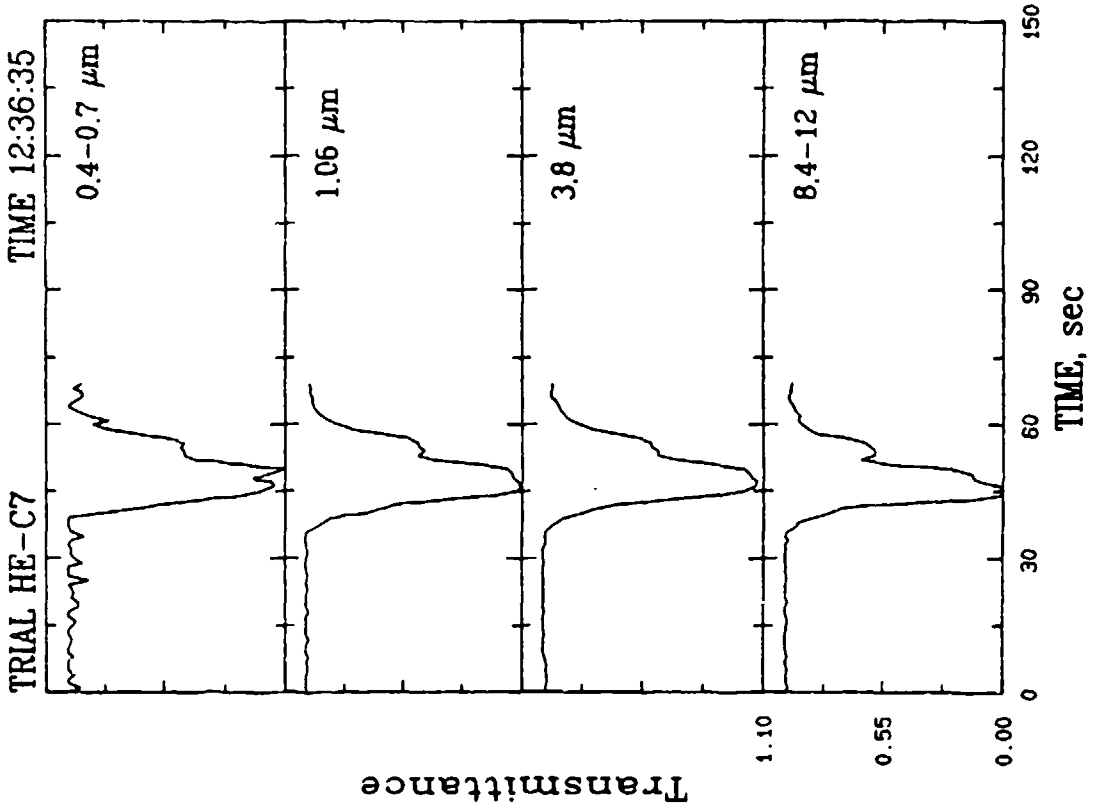
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-C 7
TIME 12:37:11
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec

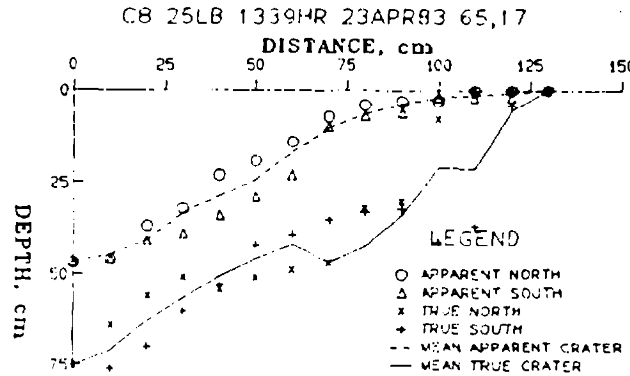

TRIAL HE-C 7
TIME 12:37:11
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.10
0.05
0.00
0
30
60
90
120
150
TIME, sec

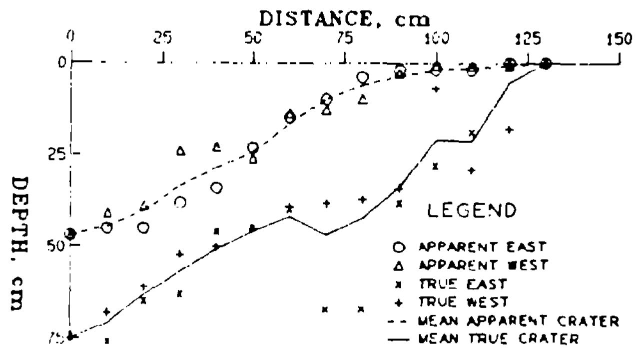


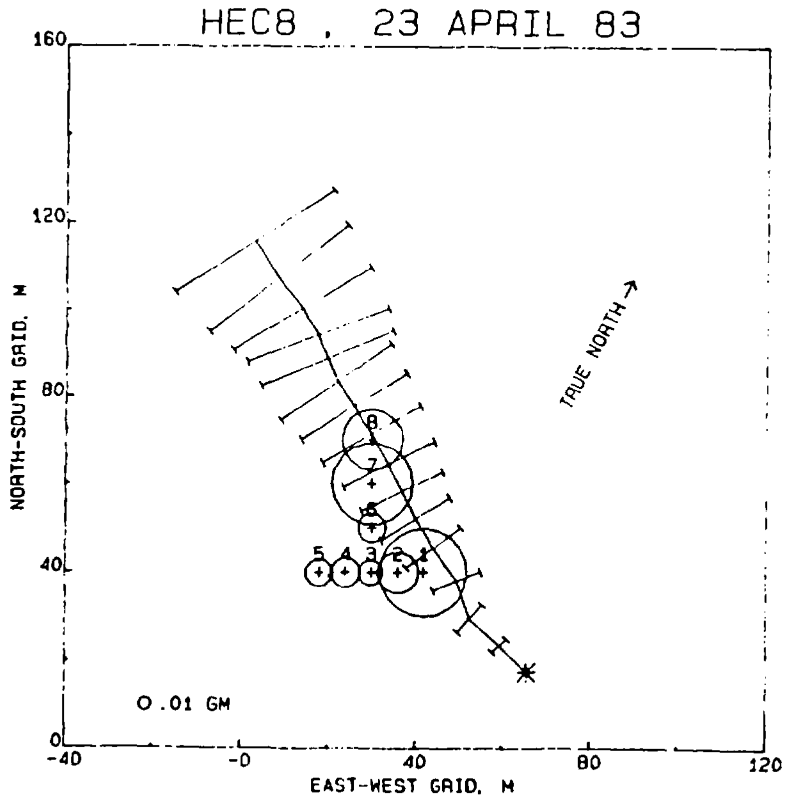
TRIAL HE-C7
TIME 12:36:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
1
-2
-5
Ln Transmittance
0
30
60
90
120
150
TIME, sec



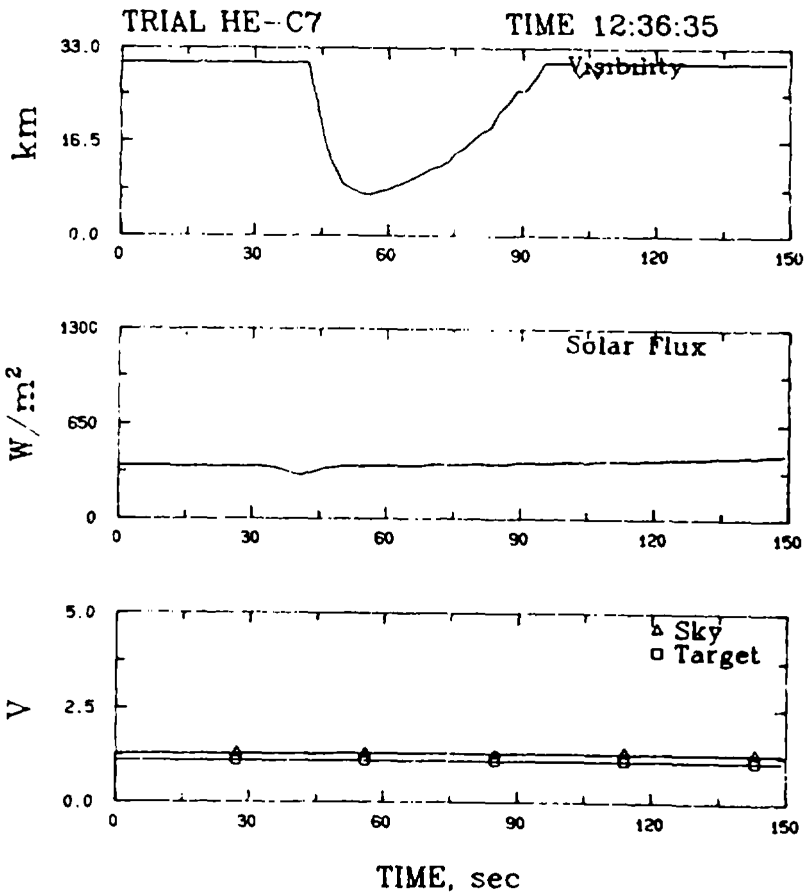
TRIAL HE-C7
TIME 12:36:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
1.10
0.55
0.00
Transmittance
0
30
60
90
120
150
TIME, sec

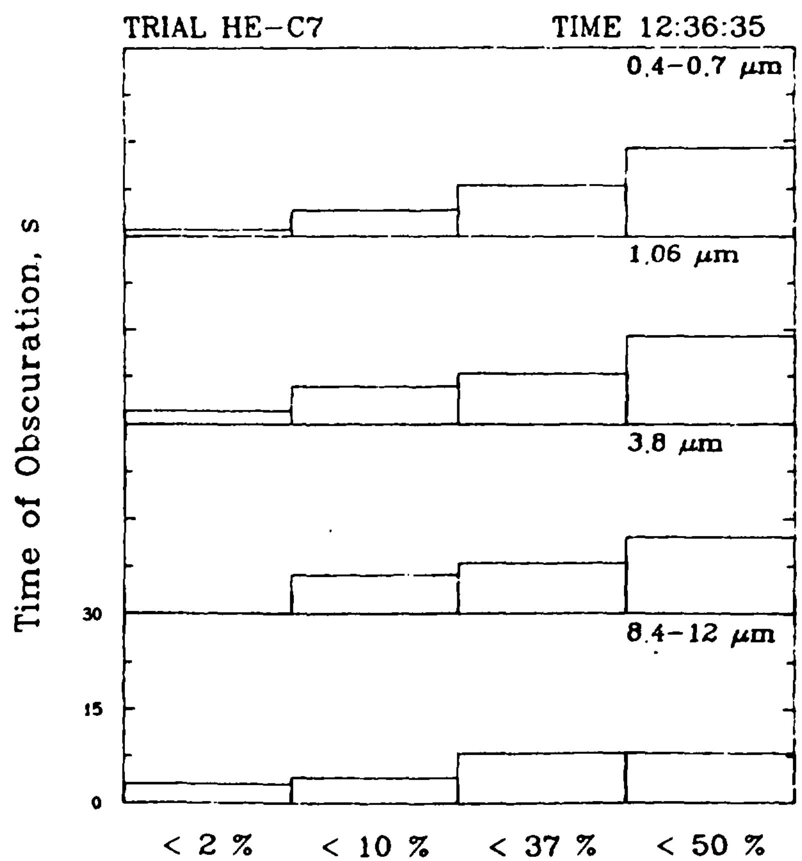






MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS


TRIAL HE-C7
TIME 12:36:35
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
Sky
Target
V
5.0
2.5
TIME, sec


TRIAL HE-C7
TIME 12:36:35
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC8

Surface Tangent

Date: 23 APRIL 83

Charge Shape: BLOCK

Detonation Coordinates (M):
X: 65.3
Y: 17.5

Charge Wt: 25.0 LB
Event Time: 13:39:30

METEOROLOGICAL DATA:

Pasquill Category: B
Richardson Number: -0.714

16 Meter Tower (Means)
Start Time: 13:38:10 End Time: 13:41:39

	2M	4M	6M	16M
Wind Speed (M/S)	4.60	4.84	5.17	5.65
Wind Dir. (DEG)	117.9	118.2	118.9	119.2
Sigma WSP	0.77	0.79	0.84	0.77
Sigma WDIR	8.1	7.9	7.5	8.6
UVW Components				
U (N-S) (M/S)	2.09	2.22	2.43	2.70
V (E-W) (M/S)	-4.05	-4.25	-4.52	-4.90
W (Vert) (M/S)	0.28	0.35	0.31	•
Sigma U	0.53	0.52	0.48	0.67
Sigma V	0.85	0.88	0.94	0.90
Sigma W	0.25	0.31	0.34	•
Temperature (C)	16.7	15.7	15.1	14.7

Soil Temperature (C): 2?.3

Solar Flux (W/M**2): 1034.5

Dew Point (C): 2.5

Visual Range (M): 30480.0

Temperature (C): 15.6

Vista Ranger Voltages:
Sky: 1.40
Target: 1.24

Rel. Hum. (%): 41.2

Abs. Hum. (G/M**3): 5.50

Sky-Target Contrast: -0.11

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	65.0 17.0	42	220	305	410
Post-Shot	65.0 17.0	•	•	•	•

CRATER DATA

Moisture Content: 12.1

CRATER VOLUMES (M**3):
True Crater: 1.598
Apparent Crater: 0.481
Flow: 1.117

DENSITIES (G/CM**3):
Pre-Shot: 1.480
Flow: 1.124
Bottom: 1.113
Side: 1.134

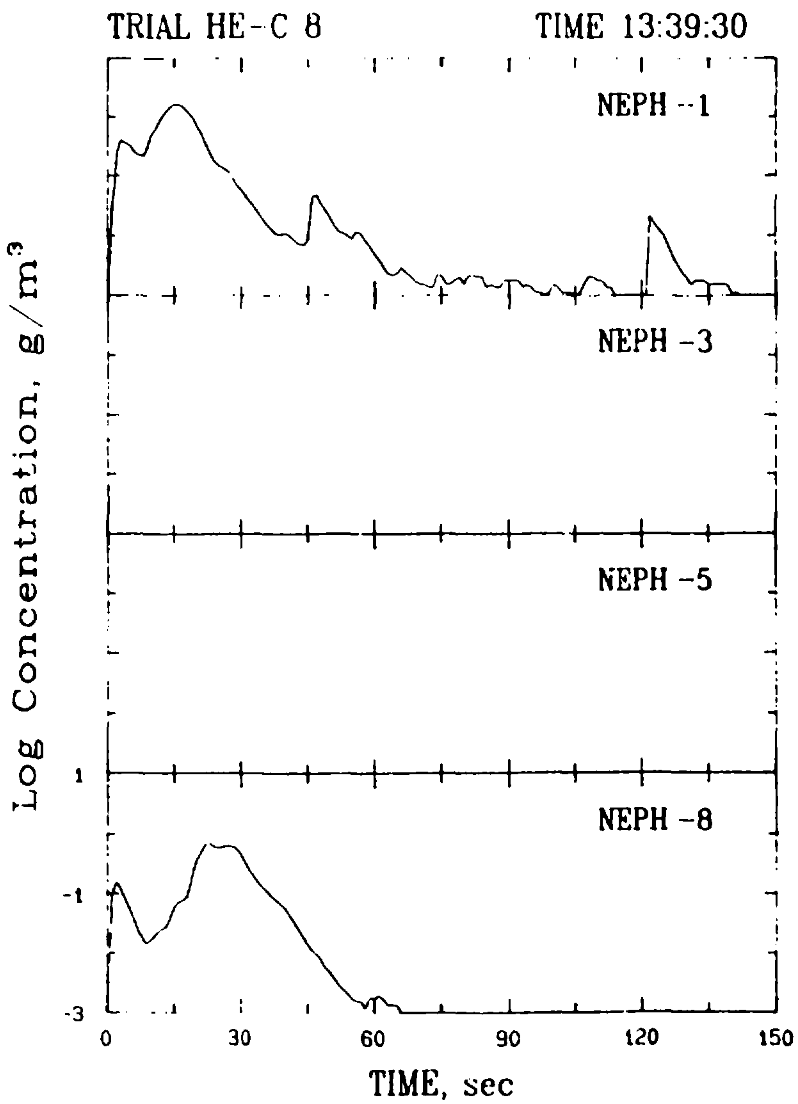
HI VOL DATA (G):

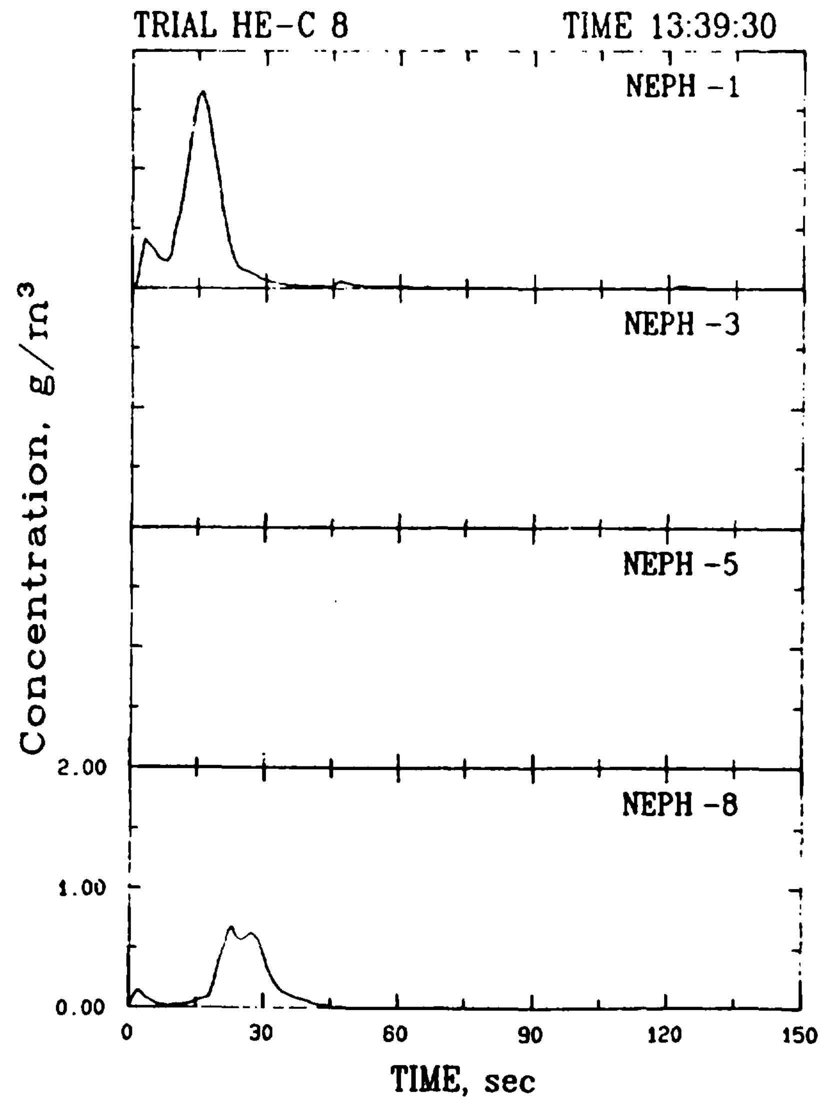
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.4490	0.0995	0.0359	0.0514	0.0439	0.0490	0.3887	0.2199

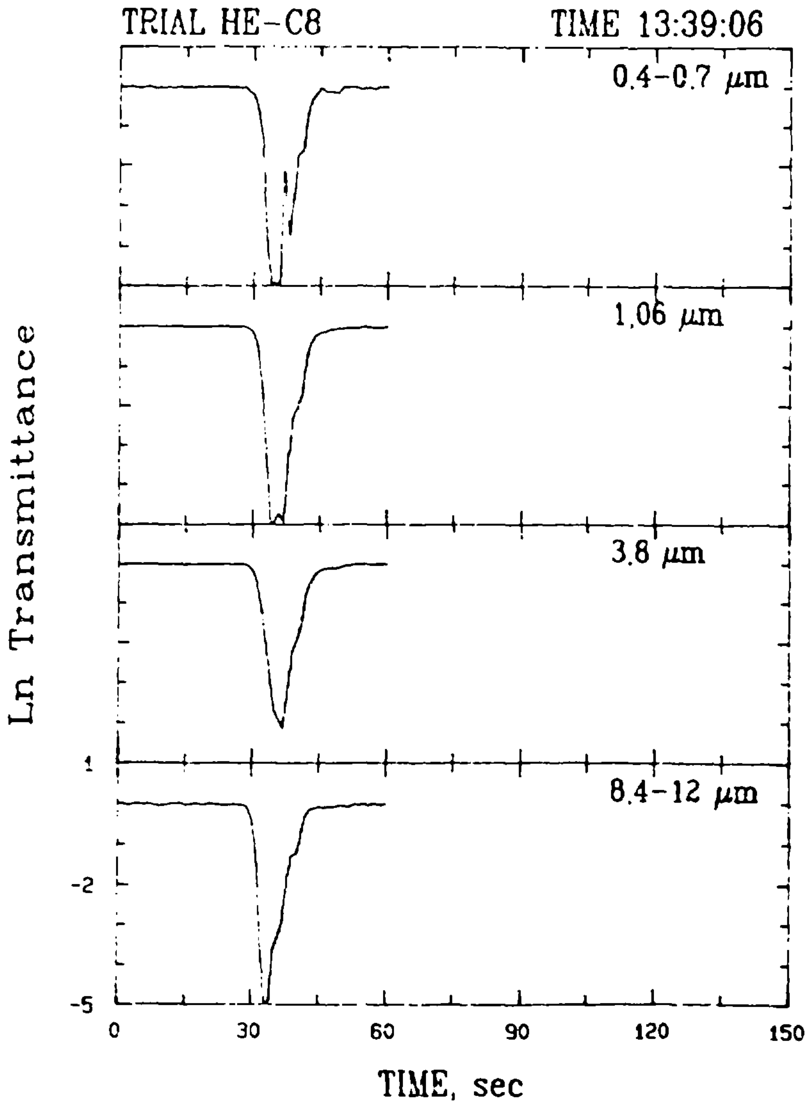
SUM: 1.3373

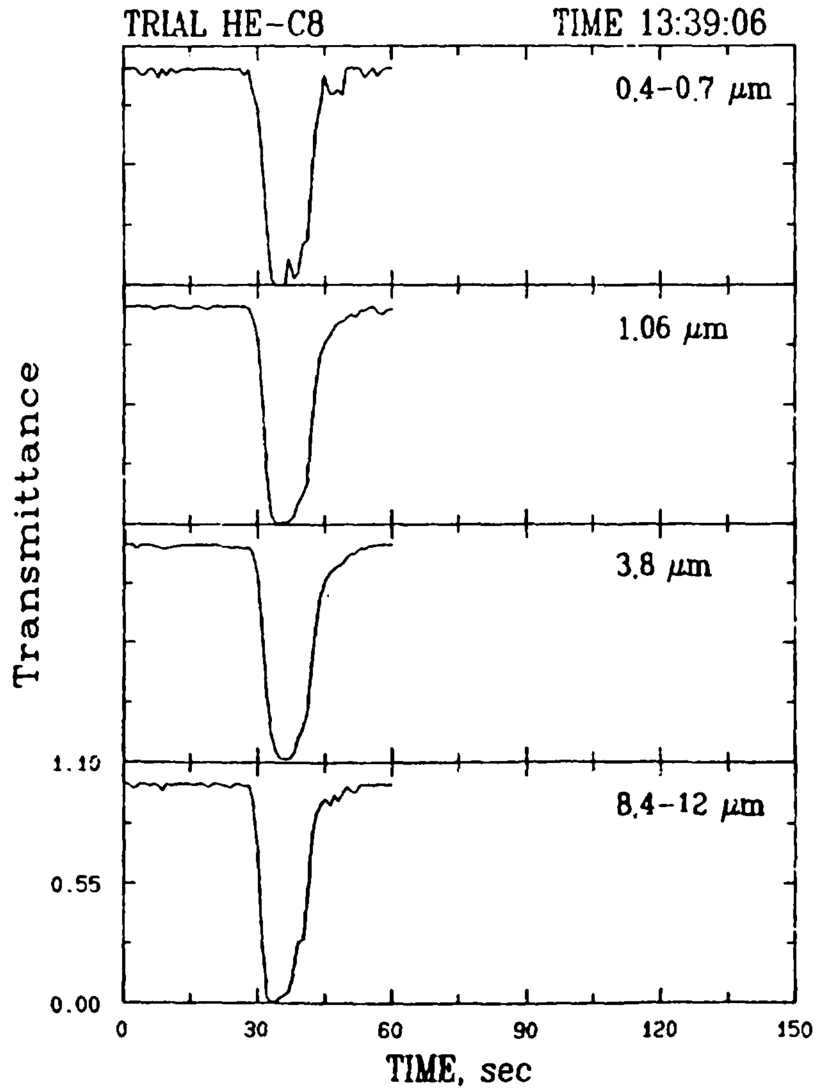
GELMAN DOSAGE (G S/M**3):

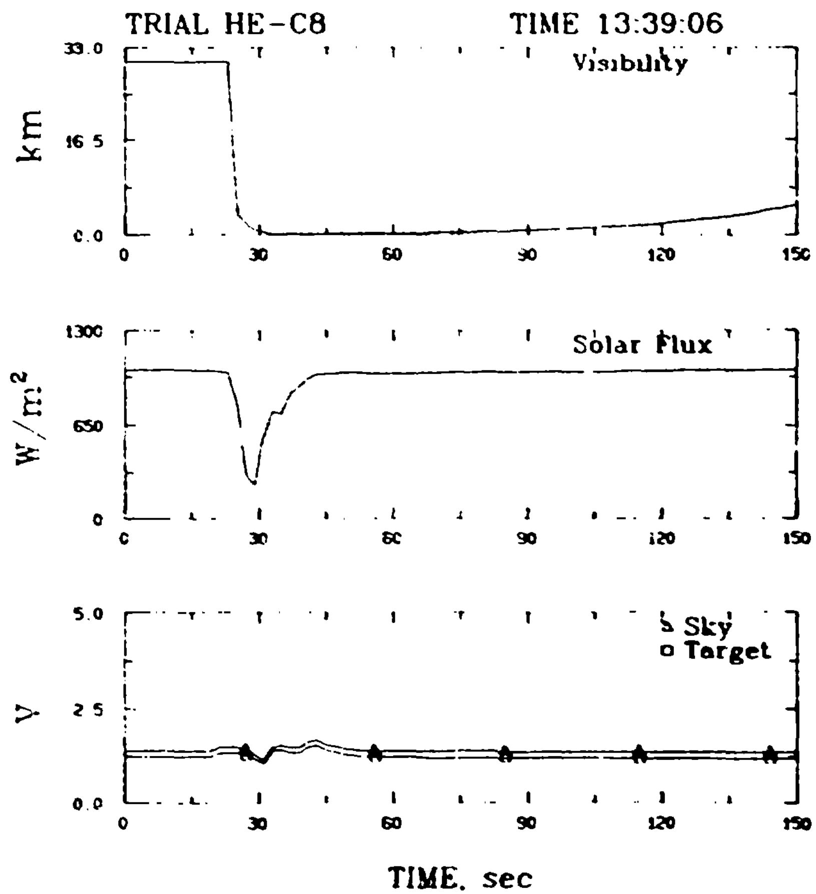
GELMAN A	GELMAN B	GELMAN C	GELMAN D
58.768	223.200	444.583	77.297

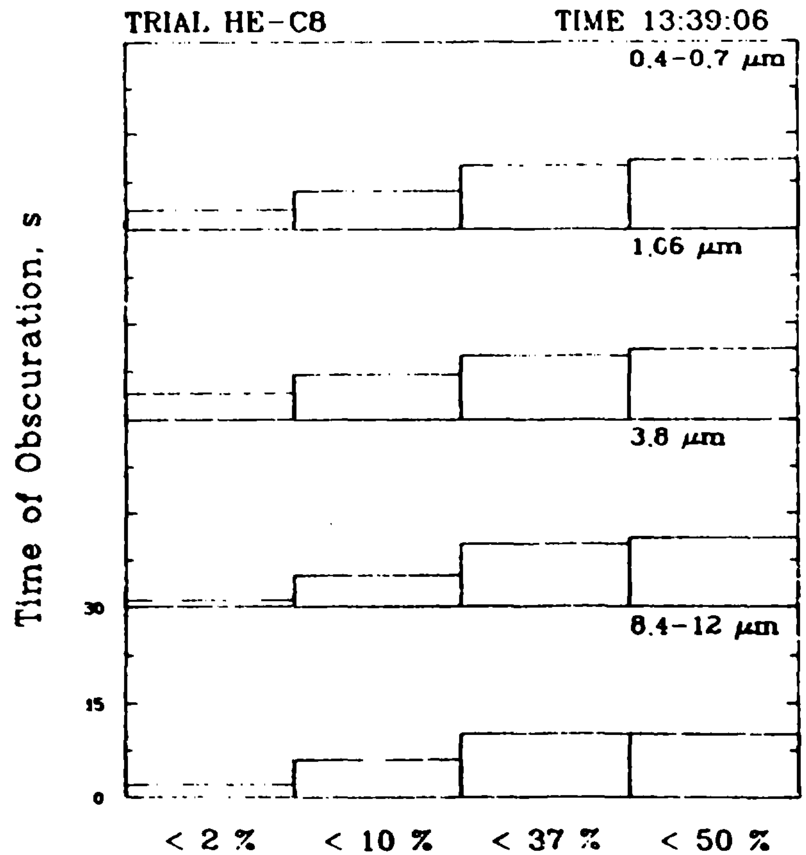

TRIAL HE-C 8
TIME 13:39:30
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m³
1
-1
-3
0
30
60
90
120
150
TIME, sec


TRIAL HE-C 8
TIME 13:39:30
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m³
2.00
1.00
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C8
TIME 13:39:06
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-C8
TIME 13:39:06
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C8
TIME 13:39:06
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec


TRIAL HE-C8
TIME 13:39:06
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC9

Surface Tangent

Date: 23 APRIL 83

Detonation Coordinates (M):
X: 75.7
Y: -13.9

Charge Shape: BLOCK

Charge Wt: 25.0 LB
Event Time: 16:19:18

METEOROLOGICAL DATA:

Pasquill Category: D
Richardson Number: -0.138

16 Meter Tower (Means)
Start Time: 16:16:48 End Time: 16:21:16

	2M	4M	6M	16M
Wind Speed (M/S)	4.85	5.28	5.64	6.55
Wind Dir. (DEG)	140.3	140.5	140.7	138.5
Sigma WSP	0.80	0.80	0.83	0.79
Sigma WDIR	12.5	12.5	11.8	11.0
UVW Components				
U (N-S) (M/S)	3.61	3.96	4.23	4.79
V (E-W) (M/S)	-3.05	-3.30	-3.53	-4.29
W (Vert) (M/S)	0.28	0.49	0.32	*
Sigma U	0.75	0.85	0.83	0.85
Sigma V	1.11	1.13	1.18	1.24
Sigma W	0.26	0.34	0.34	*
Temperature (C)	16.0	15.6	15.2	14.8

Soil Temperature (C): 25.1

Solar Flux (W/M**2): 186.5

Dew Point (C): 2.2

Visual Range (M): 30480.0

Temperature (C): 15.0

Vista Ranger Voltages:
Sky: 1.43
Target: 1.25

Rel. Hum. (%): 41.9

Abs. Hum. (G/M**3): 5.40

Sky-Target Contrast: -0.12

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	77.0 -14.0	50	335	685	750+
Post-Shot	77.0 -14.0	25	195	550	750+

CRATER DATA

Moisture Content: 11.7

CRATER VOLUMES (M**3):
True Crater: 1.327
Apparent Crater: 0.694
Flow: 0.633

DENSITIES (G/CM**3):
Pre-Shot: 1.450
Flow: 1.093
Bottom: 1.124
Side: 1.061

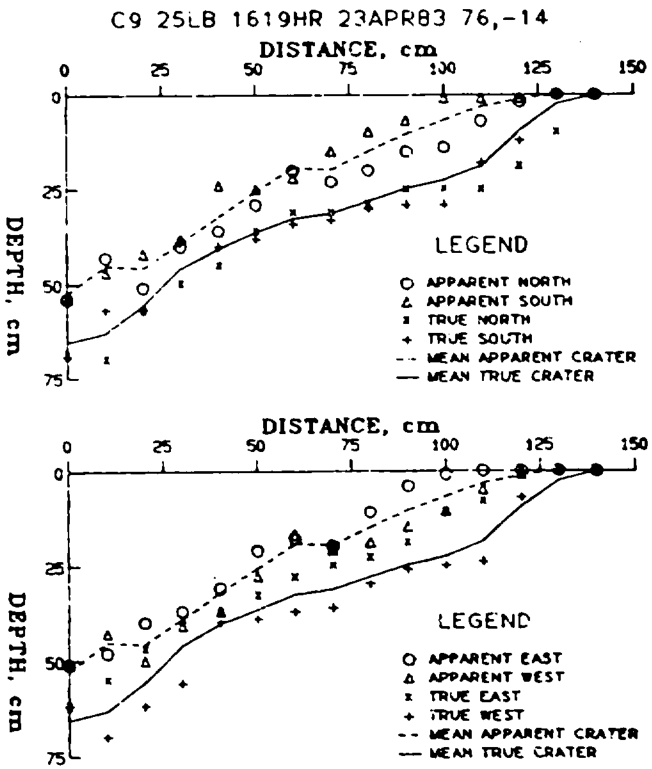
HI VOL DATA (G):

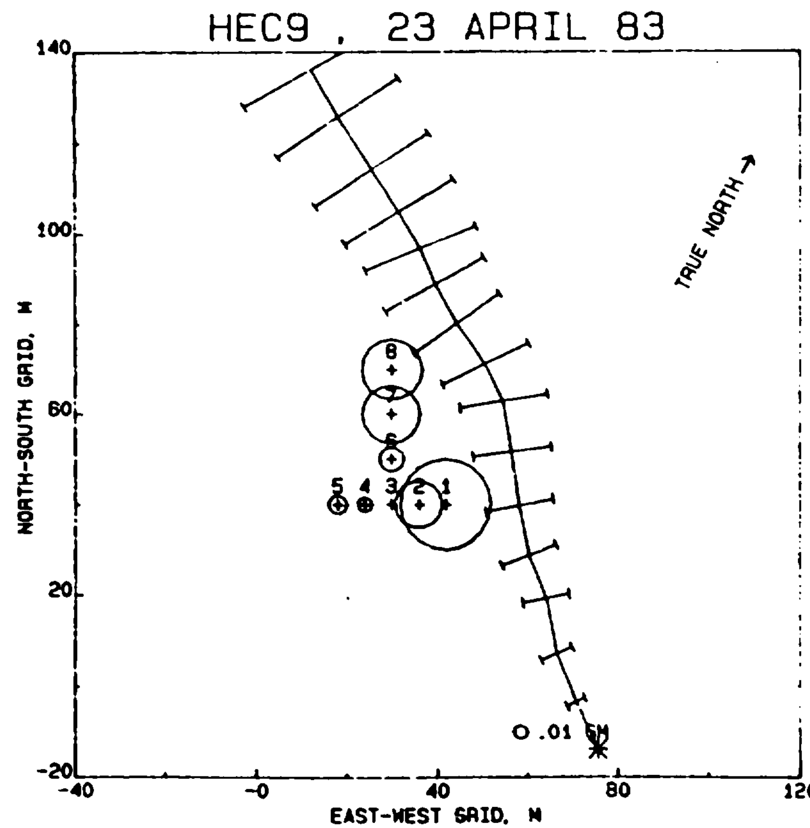
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.4746	0.1274	0.0000	0.0132	0.0203	0.0351	0.1926	0.2131

SUM: 1.0763

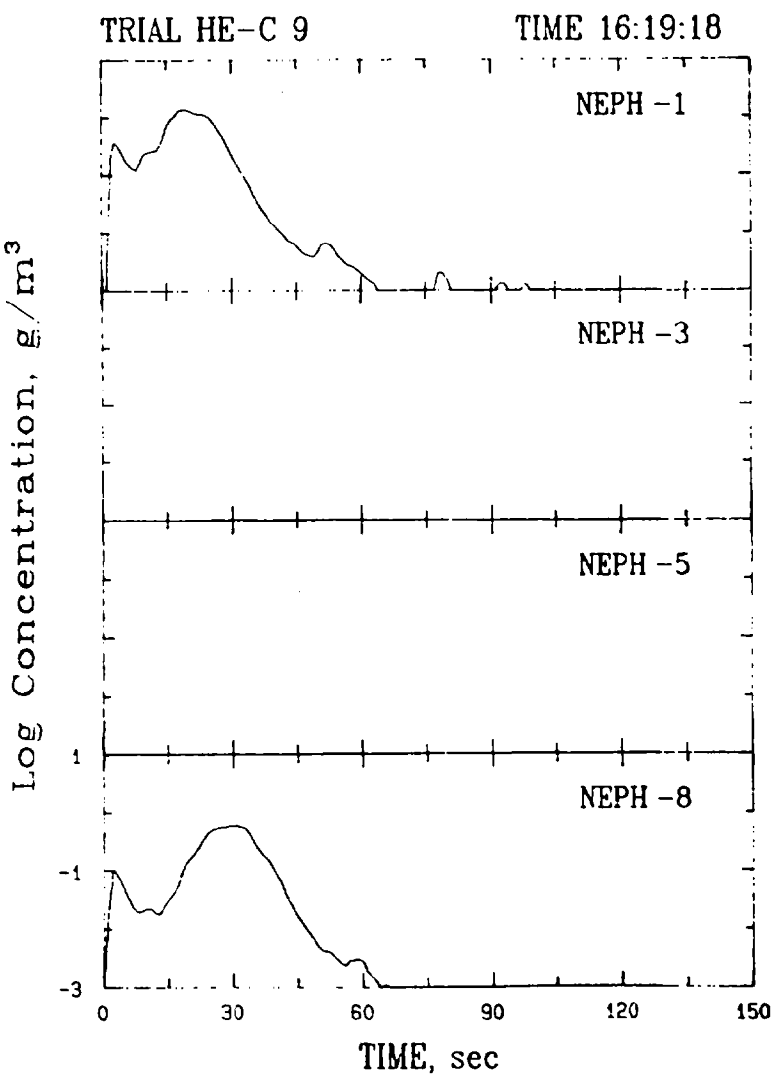
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
61.611	139.200	63.512	59.459

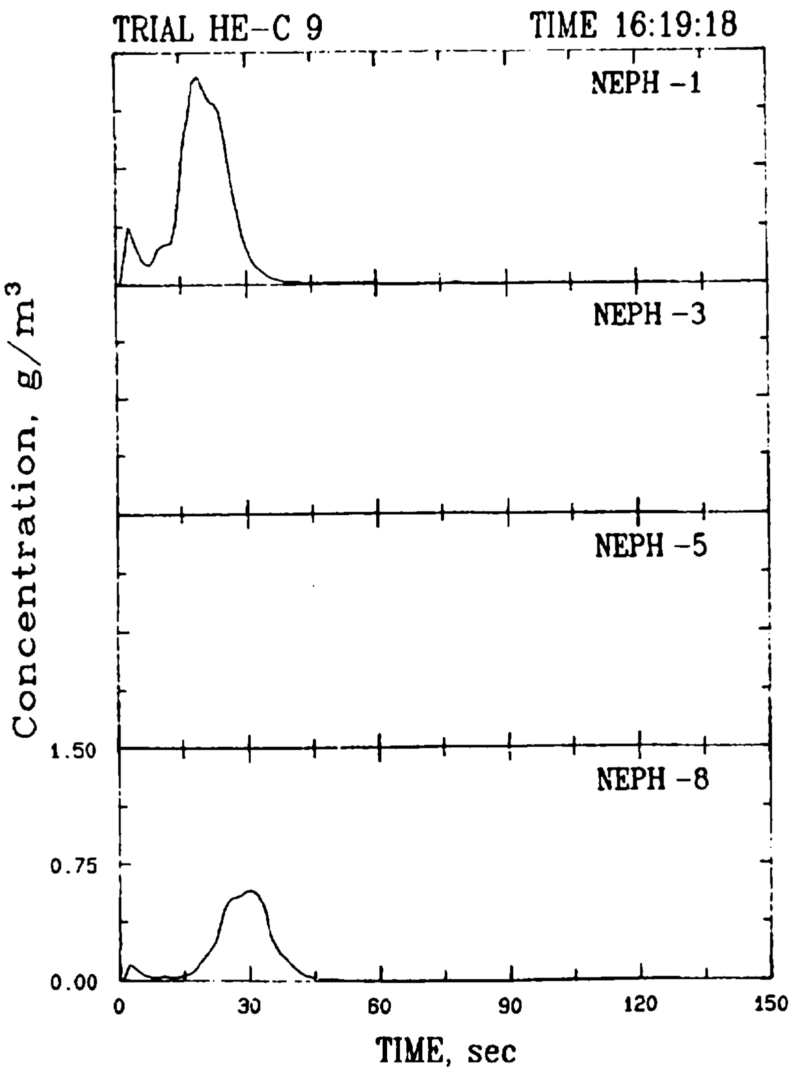




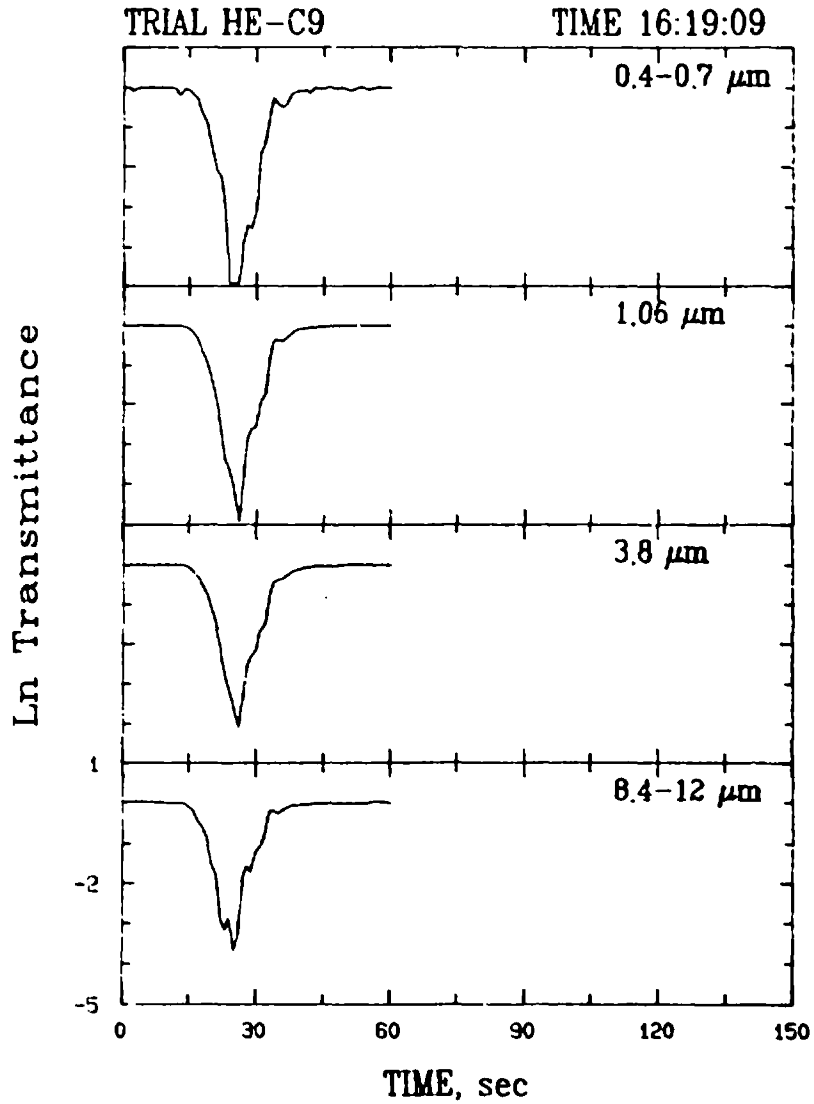
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS



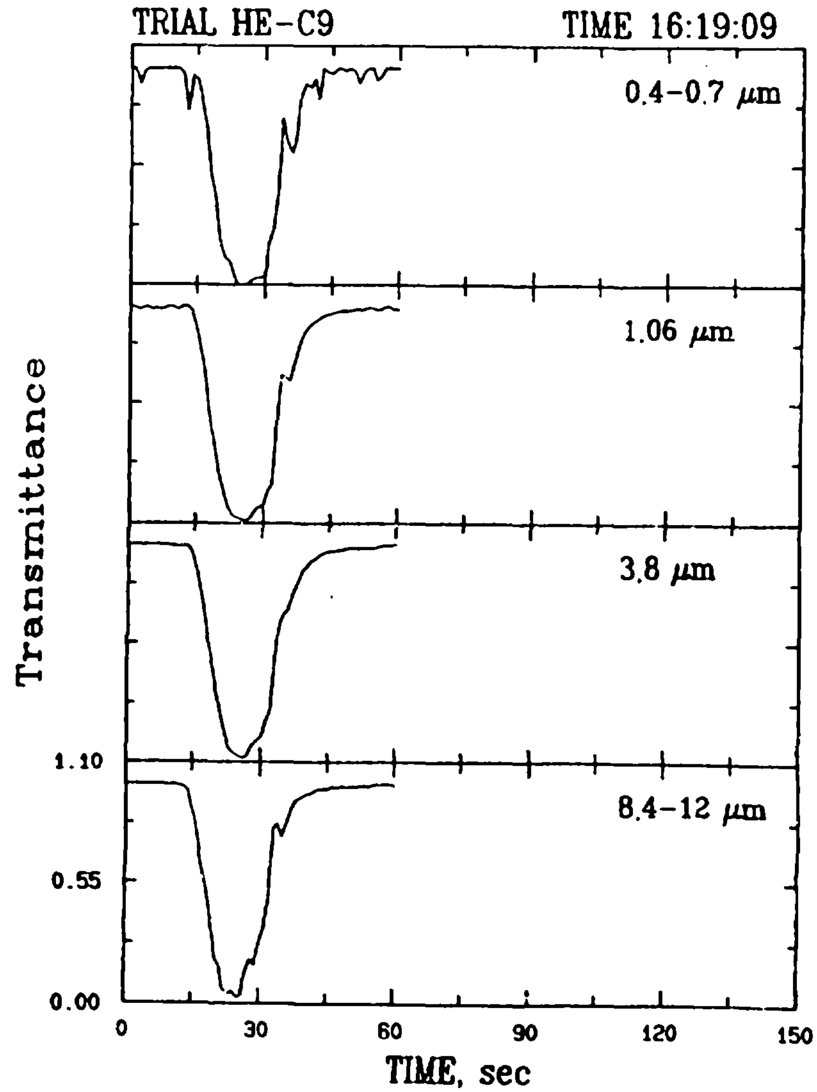
TRIAL HE-C 9
TIME 16:19:18
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec



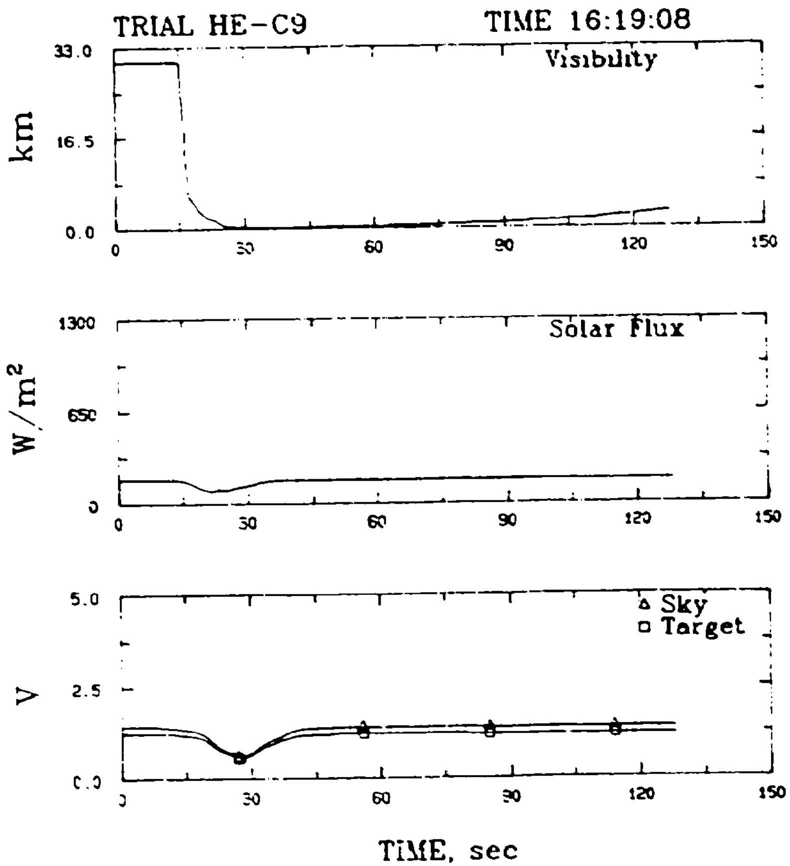
TRIAL HE-C 9
TIME 16:19:18
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
1.50
0.75
0.00
0
30
60
90
120
150
TIME, sec

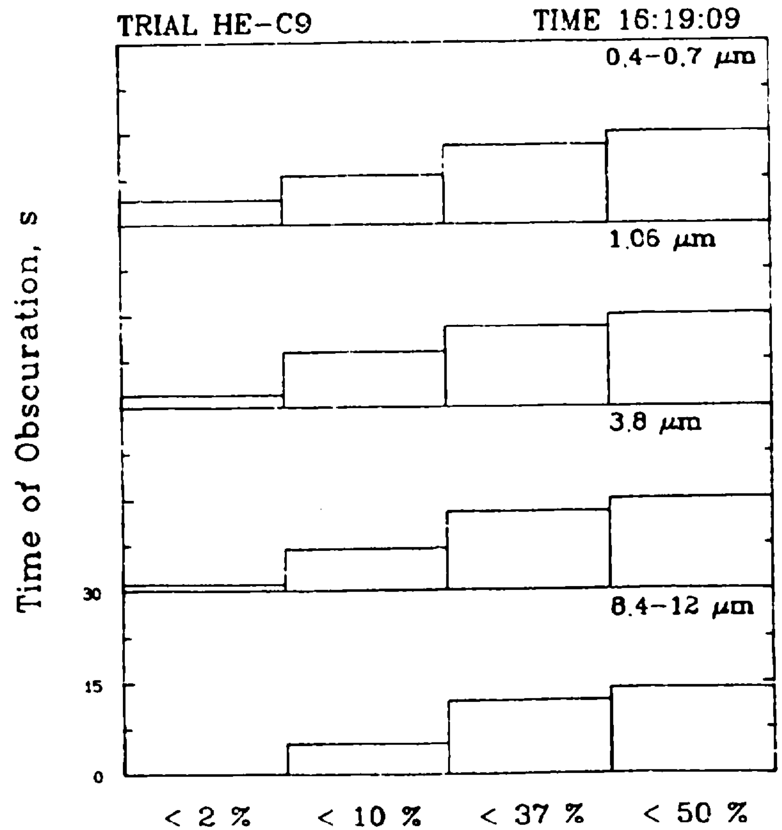


TRIAL HE-C9
TIME 16:19:09
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec



TRIAL HE-C9
TIME 16:19:09
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C9
TIME 16:19:08
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
V
5.0
2.5
0.0
Sky
Target
0
30
60
90
120
150
TIME, sec


TRIAL HE-C9
TIME 16:19:09
0.4-0.7 µm
1.06 µm
3.8 µm
8.4-12 µm
Time of Obscuration, s
30
15
0
< 2 %
< 10 %
< 37 %
< 50 %

EVENT SUMMARY DATA

Test Number: HEC10

Surface Tangent

Date: 25 APRIL 83

Charge Shape: BLOCK

Detonation Coordinates (M):
X: 10.2
Y: 23.5

Charge Wt: 25.0 LB
Event Time: 14:09:22

METEOROLOGICAL DATA:

Pasquill Category: C
Richardson Number: -0.122

16 Meter Tower (Means)
Start Time: 14: 8:27 End Time: 14:11:24

	2M	4M	6M	16M
Wind Speed (M/S)	8.07	8.94	9.21	10.30
Wind Dir. (DEG)	212.3	211.2	212.4	208.6
Sigma WSP	1.64	1.60	1.50	1.43
Sigma WDIR	13.4	12.4	13.1	11.7
UVW Components				
U (N-S) (M/S)	6.64	7.45	7.54	8.85
V (E-W) (M/S)	4.23	4.59	4.89	4.85
W (Vert) (M/S)	0.08	0.59	-0.02	*
Sigma U	1.68	1.56	1.47	1.54
Sigma V	1.76	1.89	2.06	1.99
Sigma W	0.28	0.33	0.33	*
Temperature (C)	24.9	24.0	23.6	22.9

Soil Temperature (C): 39.2

Solar Flux (W/M**2): 970.6

Dew Point (C): -11.4

Visual Range (M): 30480.0

Temperature (C): 24.0

Vista Ranger Voltages:
Sky: 1.84
Target: 0.88

Rel. Hum. (%): 7.7

Abs. Hum. (G/M**3): 1.67

Sky-Target Contrast: -0.52

Rain Accumulation (MM): 0.00

CONE INDEX:

	X,Y Coord (M)	SFC	15	30	45
Pre-Shot	10.0 23.0	100	213	250	235
Post-Shot	10.0 23.0	25	135	250	465

CRATER DATA

Moisture Content: 12.4

CRATER VOLUMES (M**3):
True Crater: 1.335
Apparent Crater: 0.443
Flow: 0.892

DENSITIES (G/CM**3):
Pre-Shot: 1.310
Flow: *
Bottom: 1.157
Side: 1.113

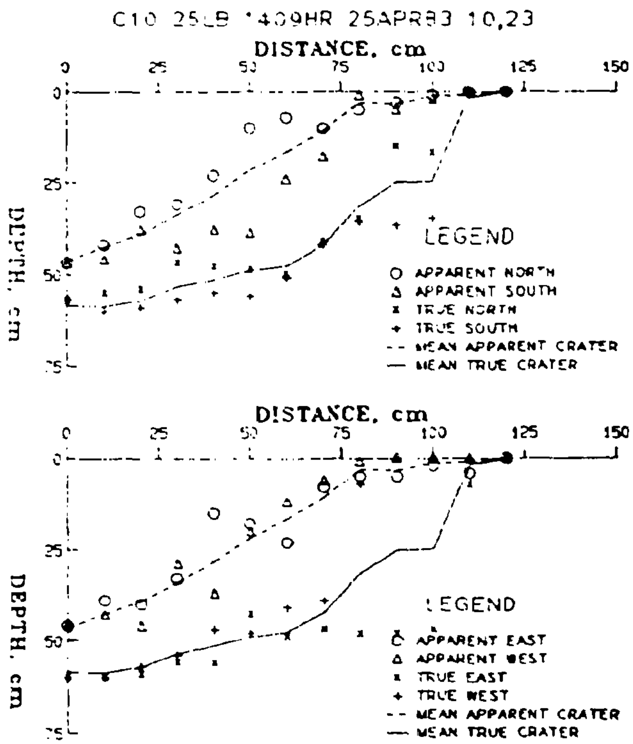
HI VOL DATA (G):

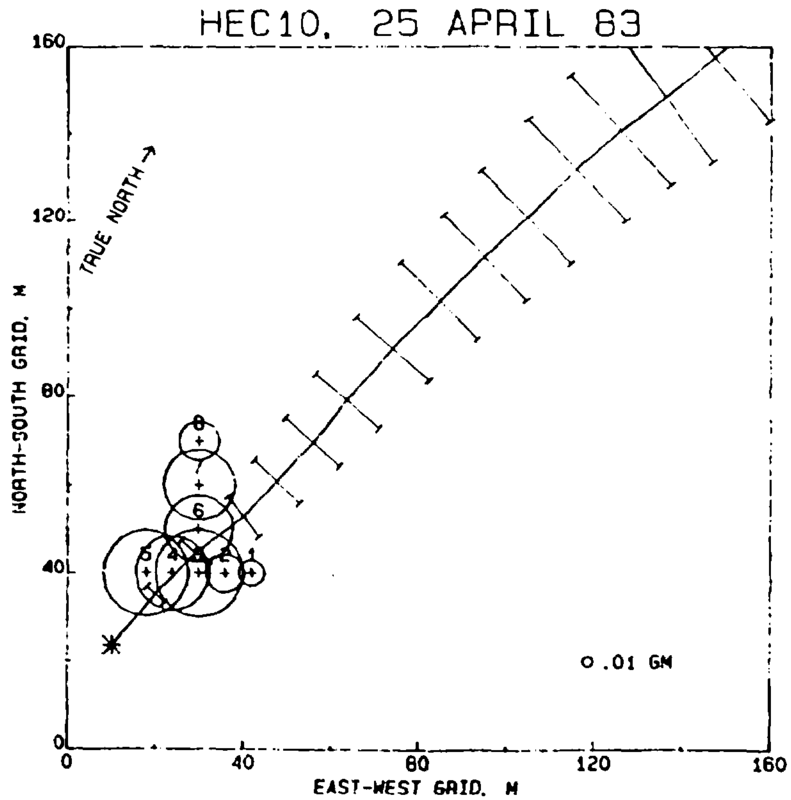
HV1	HV2	HV3	HV4	HV5	HV6	HV7	HV8
0.0540	0.1145	0.6082	0.4340	0.5880	0.3617	0.3948	0.1246

SUM: 2.6798

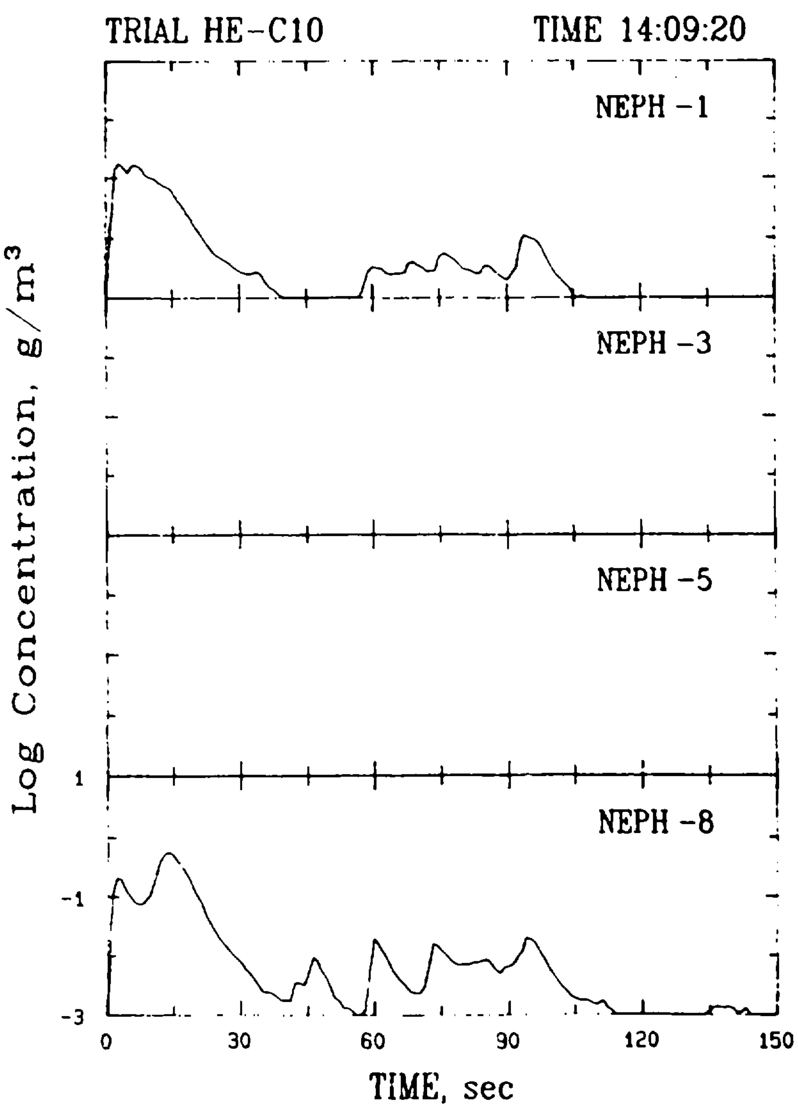
GELMAN DOSAGE (G S/M**3):

GELMAN A	GELMAN B	GELMAN C	GELMAN D
11.374	12.000	6.725	76.757

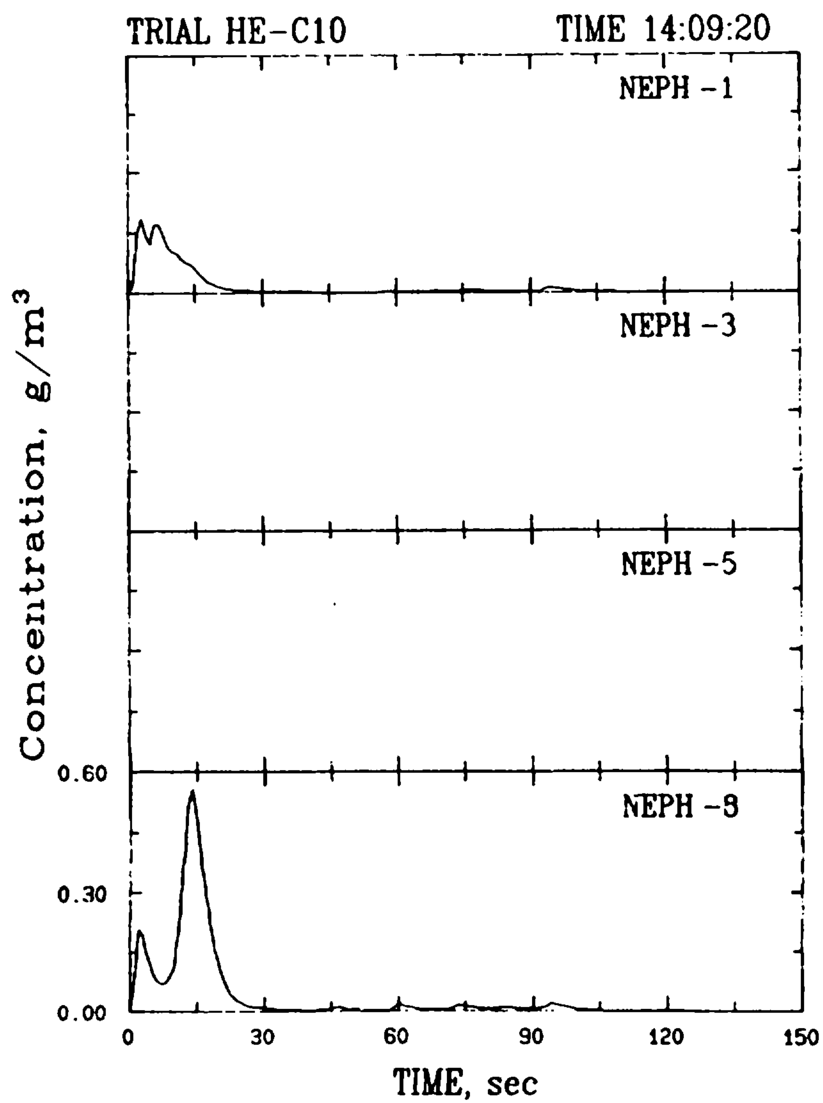




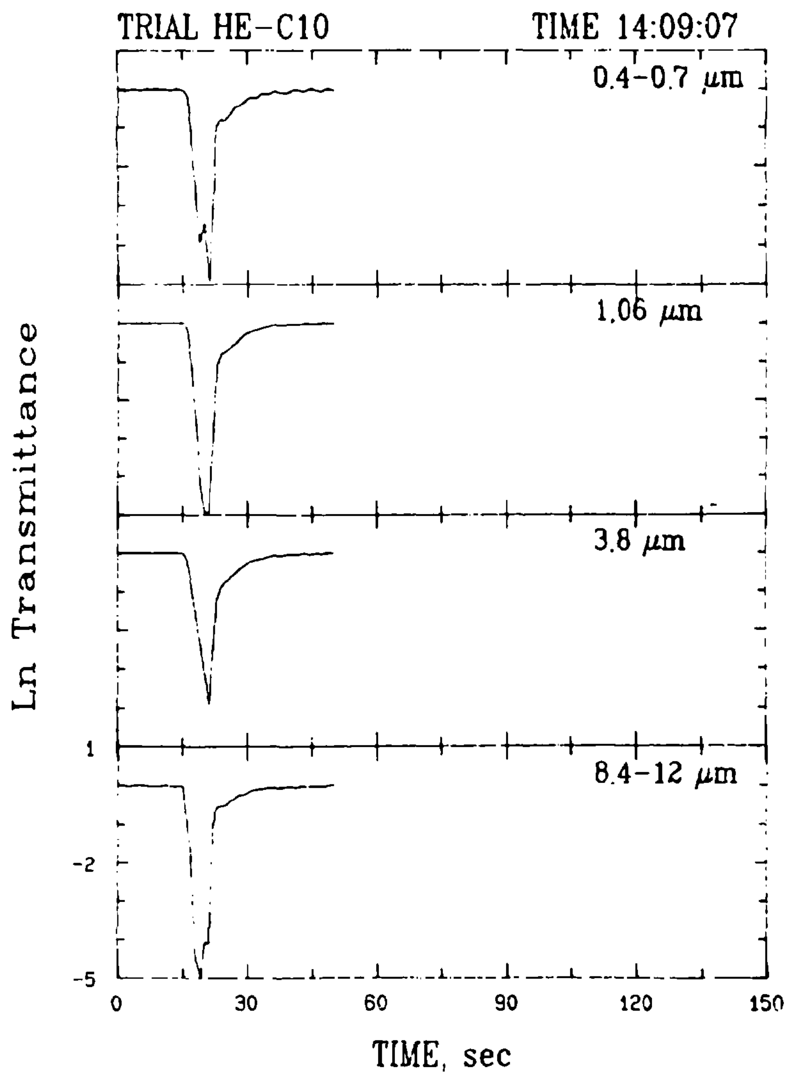
MASSES COLLECTED BY HI-VOL SAMPLERS
CLOUD PATH AND WIDTH BY 2-SEC INTERVALS

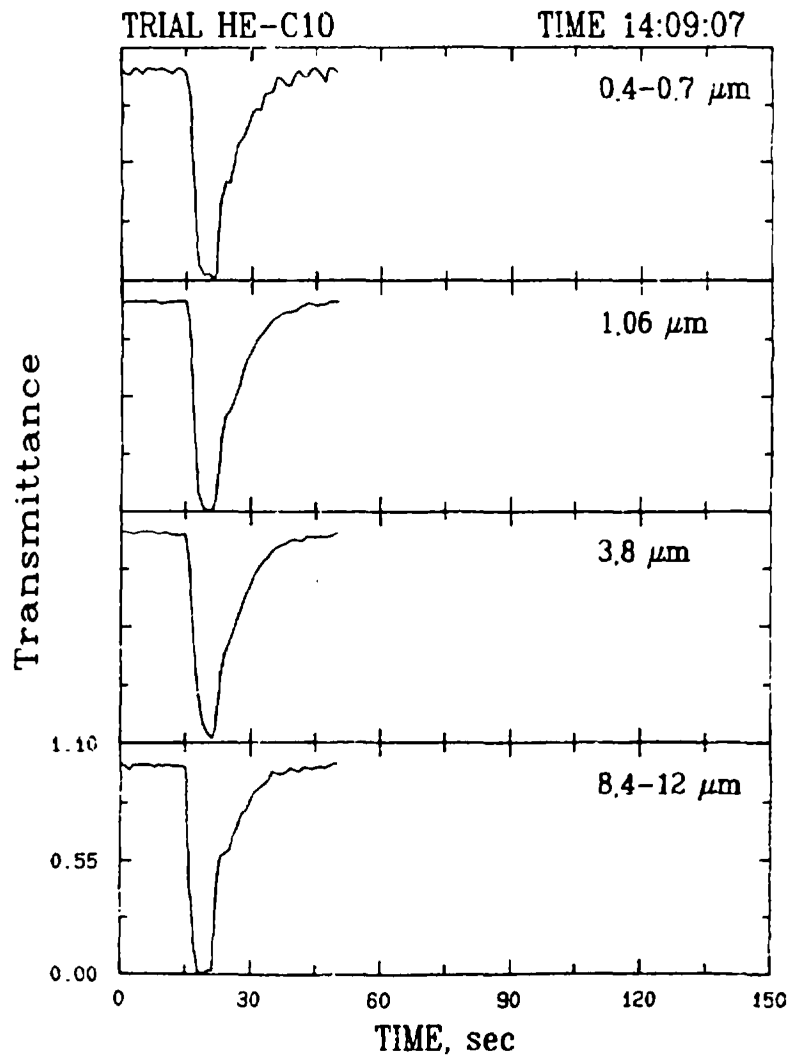


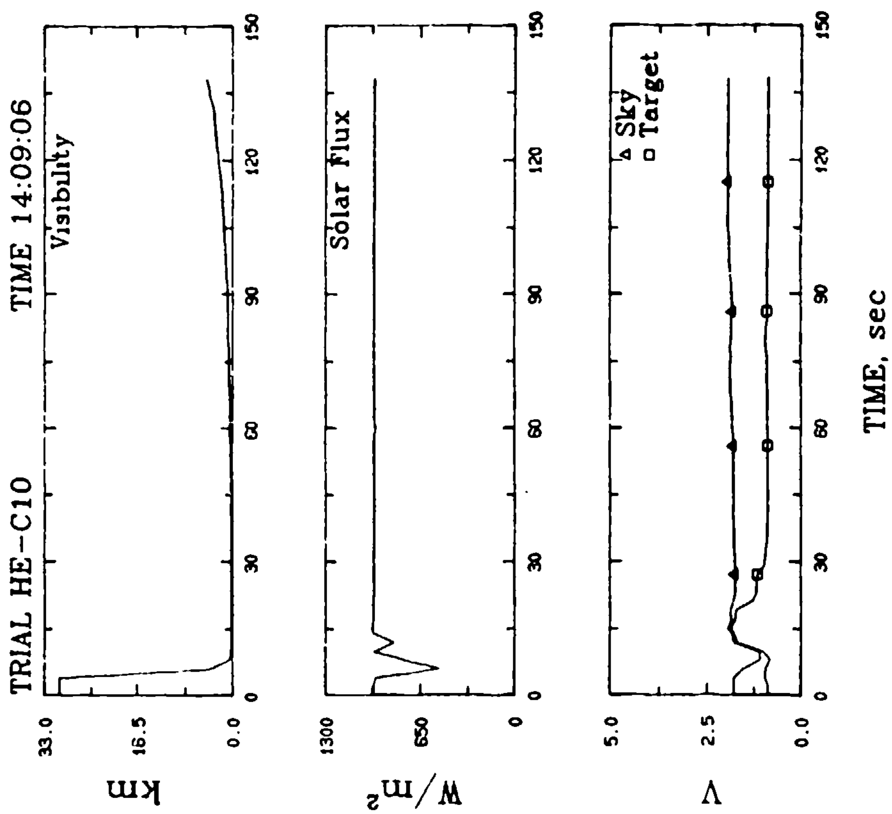
TRIAL HE-C10
TIME 14:09:20
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Log Concentration, g/m3
1
-1
-3
0
30
60
90
120
150
TIME, sec



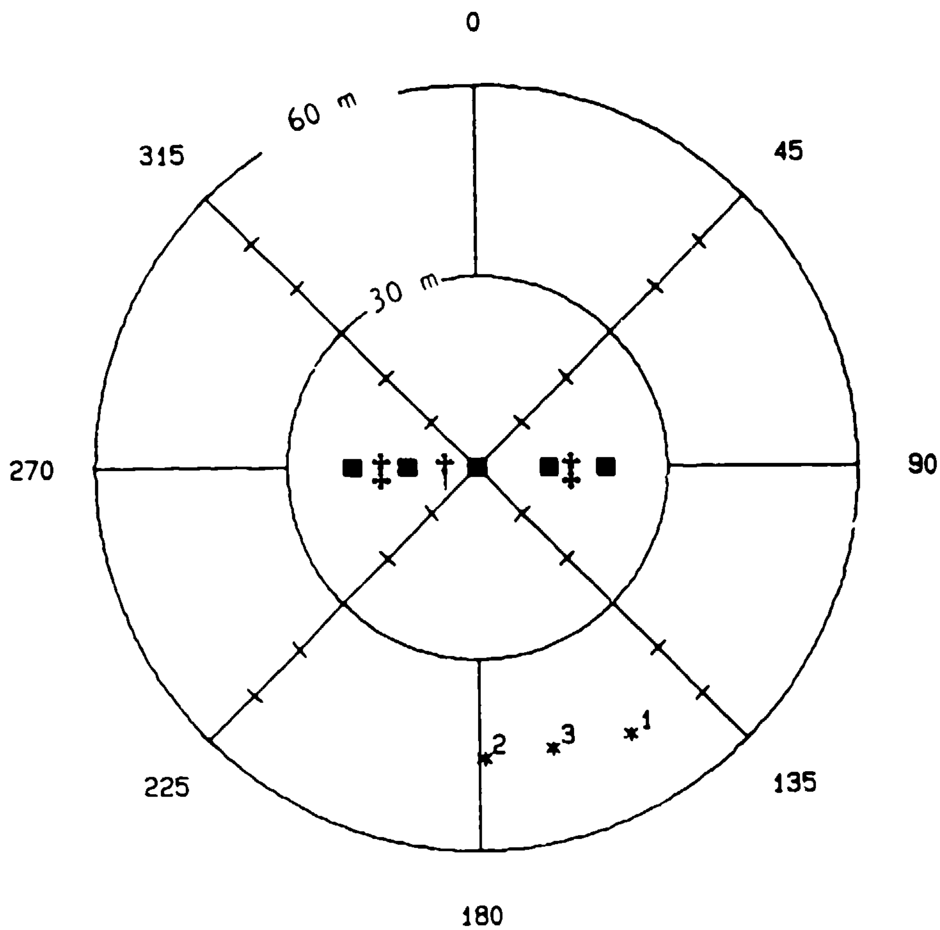
TRIAL HE-C10
TIME 14:09:20
NEPH -1
NEPH -3
NEPH -5
NEPH -8
Concentration, g/m3
0.60
0.30
0.00
0
30
60
90
120
150
TIME, sec


TRIAL HE-C10
TIME 14:09:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Ln Transmittance
1
-2
-5
0
30
60
90
120
150
TIME, sec


TRIAL HE-C10
TIME 14:09:07
0.4-0.7 μm
1.06 μm
3.8 μm
8.4-12 μm
Transmittance
1.10
0.55
0.00
0
30
60
90
120
150
TIME, sec



TRIAL HE-C10
TIME 14:09:06
Visibility
km
33.0
16.5
0.0
Solar Flux
W/m²
1300
650
0
Sky
Target
V
5.0
2.5
0.0
0
30
60
90
120
150
TIME, sec



† — MET TOWER
‡ — TETHERED BALLOONS
■ — HI-VOL SAMPLERS
* — DETONATION LOCATIONS
FOR SHOTS 1B, 2B, AND 3C

EVENT SUMMARY DATA

Test Number: HE1B (TEST 8)

Surface Tangent

Date 04 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 150
RANGE (M): 50

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 12:11

METEOROLOGICAL DATA:

Start Time: 11:45   End Time: 12:07

Wind Speed (M/S): 2.5

Wind Direction (DEG): 170

Temperature (C): 26.7

Relative Humidity (%): 46

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	50.0 150.0	•	333	583	711
Post-Shot	50.0 150.0	•	358	628	733

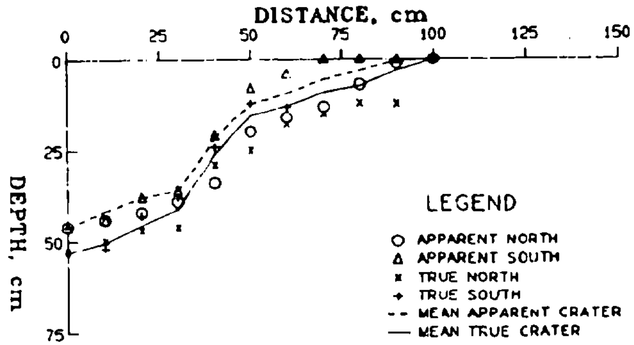
CRATER DATA

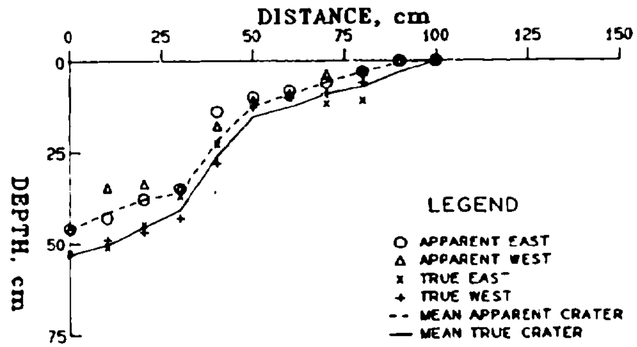
Moisture Content: 11.6

CRATER VOLUMES (M**3):
True Crater: 0.480
Apparent Crater: 0.320
Flow: 0.160

DENSITIES (G/CM**3):
Pre-Shot: 1.71
Post Shot: 1.85

1 C4 15LB 1211HR 4AUG83 ' 0 50M





EVENT SUMMARY DATA

Test Number: HE2B (TEST 9)

Surface Tangent

Date: 04 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 179
RANGE (M): 46

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 13:19

METEOROLOGICAL DATA:

Start Time: 12:45   End Time: 13:01

Wind Speed (M/S): 2.7

Wind Direction (DEG): 155

Temperature (C): 29.4

Relative Humidity (%): 40

CONE INDEX:

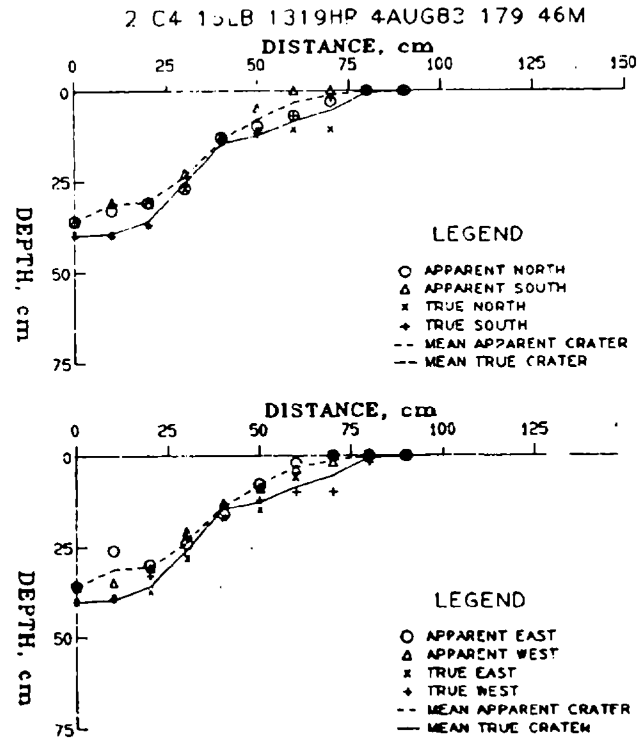
	Range, Azimuth	SFC	15	30	45
Pre-Shot	46.0 179.0	•	315	700	750+
Post-Shot	46.0 179.0	•	336	722	750+

CRATER DATA

Moisture Content: 17.5

CRATER VOLUMES (M**3):
True Crater: 0.254
Apparent Crater: 0.188
Flow: 0.066

DENSITIES (G/CM**3):
Pre-Shot: 1.94
Post Shot: 1.91



EVENT SUMMARY DATA

Test Number: HE3C (TEST 10)

Surface Tangent

Date 04 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 165
RANGE (M): 45

Charge Shape: SPHERICAL

Charge Wt: 25.0 LB
Event Time: 14:00

METEOROLOGICAL DATA.

Start Time: 13:44 End Time: 14:00

Wind Speed (M/S): 2.5

Wind Direction (DEG): 110

Temperature (C): 22.2

Relative Humidity (%): 44

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	45.0 165.0	•	317	633	750+
Post-Shot	45.0 165.0	•	255	590	667

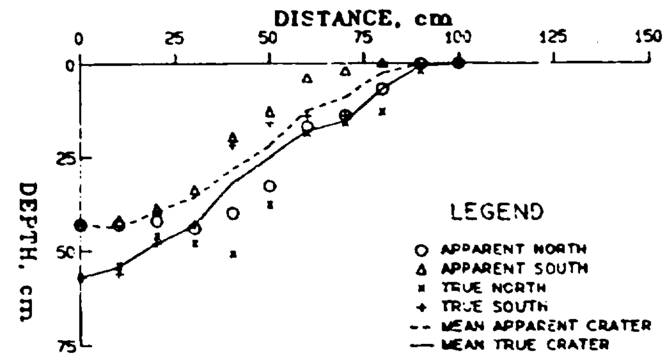
CRATER DATA

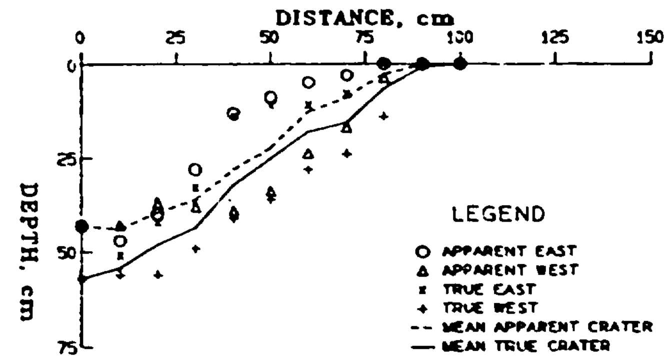
Moisture Content: 13.2

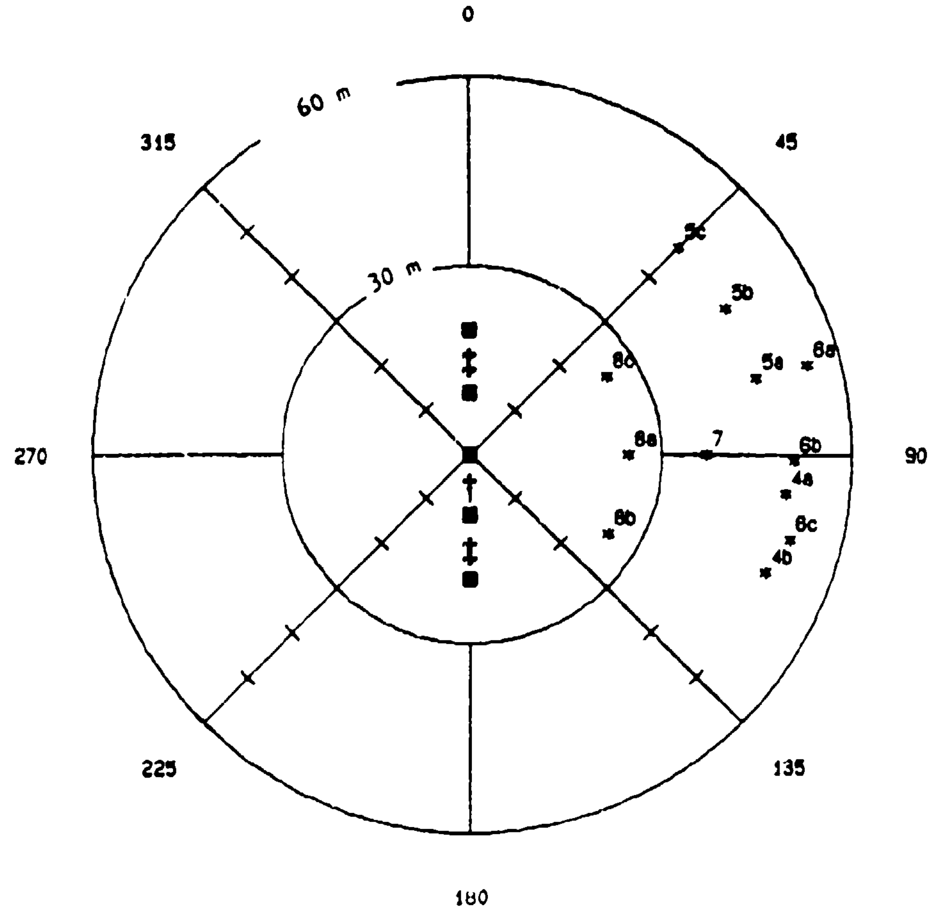
CRATER VOLUMES (M**3):
True Crater: 0.517
Apparent Crater: 0.393
Flow: 0.124

DENSITIES (G/CM**3):
Pre-Shot: 1.93
Post Shot: 1.78

3 C4 25LB 1400HR 4AUG83 165 45M







† — MET TOWER
‡ — TETHERED BALLOONS
■ — HI-VOL SAMPLERS
* — DETONATION LOCATIONS
FOR SHOTS

EVENT SUMMARY DATA

Test Number: HE4B-a (TEST 11)

Surface Tangent

Date: 04 AUGUST 83

Charge Shape: SPHERICAL

Detonation Coordinates :
AZIMUTH (DEG): 112
RANGE (M): 50

Charge Wt: 15.0 LB
Event Time: 15:30

METEOROLOGICAL DATA:

Start Time: 14:34 End Time: 15:10

Wind Speed (M/S): 3.4

Wind Direction (DEG): 115

Temperature (C): 30.0

Relative Humidity (%): 40

CONE INDEX:

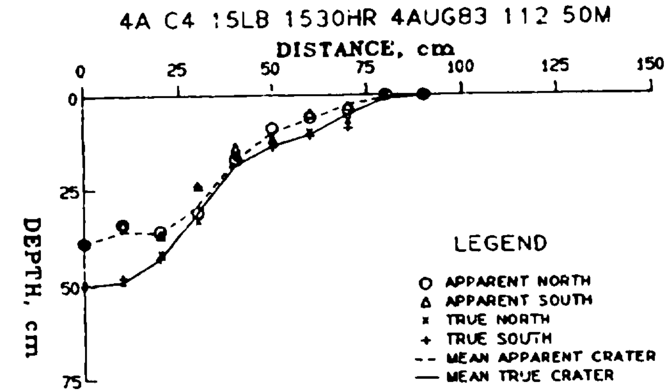
	Range, Azimuth	SFC	15	30	45
Pre-Shot	50.0 112.0	•	317	617	745
Post-Shot	50.0 112.0	•	328	472	505

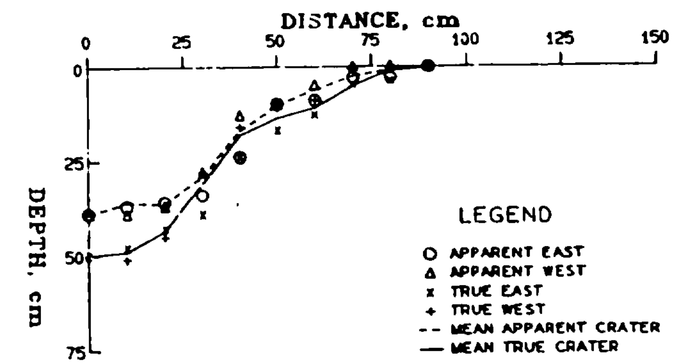
CRATER DATA

Moisture Content: 11.6

CRATER VOLUMES (M**3):
True Crater: 0.309
Apparent Crater: 0.243
Flow: 0.066

DENSITIES (G/CM**3):
Pre-Shot: 1.78
Post Shot: 1.76





EVENT SUMMARY DATA

Test Number: HE4B-b (TEST 11)

Surface Tangent

Date: 04 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 097
RANGE (M): 50

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 15:40

METEOROLOGICAL DATA:

Start Time: 14:34 End Time: 15:10

Wind Speed (M/S): 3.4

Wind Direction (DEG): 115

Temperature (C): 30.0

Relative Humidity (%): 40

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	50.0 097.0	*	*	*	*
Post-Shot	50.0 097.0	*	322	695	750+

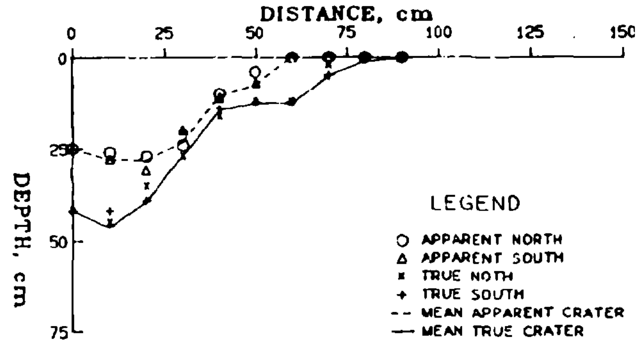
CRATER DATA

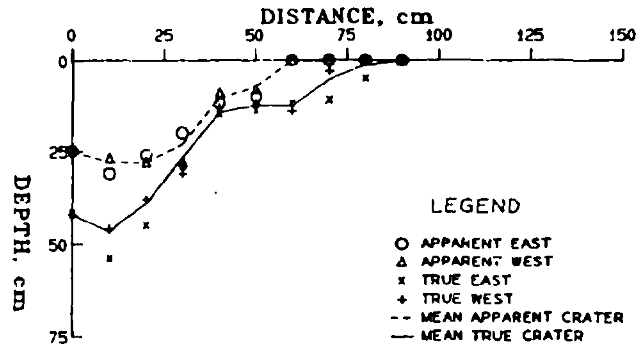
Moisture Content: 10.5

CRATER VOLUMES (M**3):
True Crater: 0.288
Apparent Crater: 0.151
Flow: 0.137

DENSITIES (G/CM**3):
Pre-Shot: 1.70
Post Shot: 1.70

4B C4 15LB 1540HR 4AUG83 97 50M





EVENT SUMMARY DATA

Test Number: HESB-a (TEST 14)

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 075
RANGE (M): 46

Surface Tangent

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 11:50

METEOROLOGICAL DATA:

Start Time: 11:10 End Time: 11:44

Wind Speed (M/S): 3.4

Wind Direction (DEG): 080

Temperature (C): NO DATA

Relative Humidity (%): NO DATA

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	47.0 061.0	•	578	750+	750+
Post-Shot	46.0 075.0	•	330	703	750+

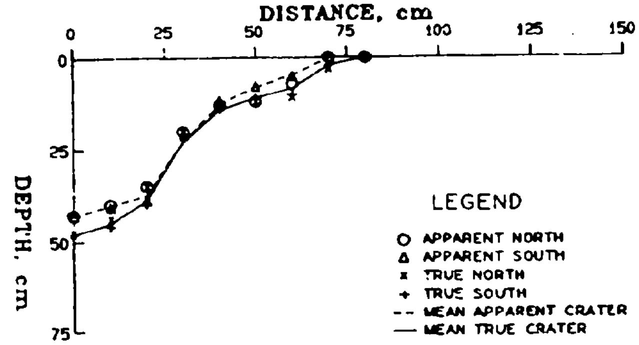
CRATER DATA

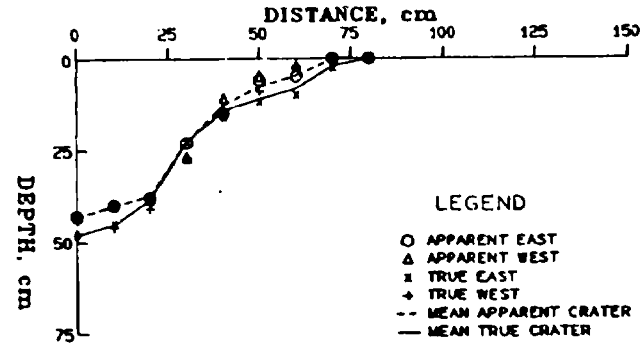
Moisture Content: 7.9

CRATER VOLUMES (M**3):
True Crater: 0.238
Apparent Crater: 0.196
Flow: 0.042

DENSITIES (G/CM**3):
Pre-Shot: 1.69
Post Shot: 1.71

5A C4 15LB 1150HR 5AUG83 75 46M





EVENT SUMMARY DATA

Test Number: HE5B-b (TEST 14)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 061
RANGE (M): 47

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: 11:52

METEOROLOGICAL DATA:

Start Time: 11:10   End Time: 11:44

Wind Speed (M/S): 3.4

Wind Direction (DEG): 080

Temperature (C): NO DATA

Relative Humidity (%): NO DATA

CONE INDEX:

	Range.	Azimuth	SFC	15	30	45
Pre-Shot	47.0	061.0	•	•	•	•
Post-Shot	47.0	061.0	•	439	728	750+

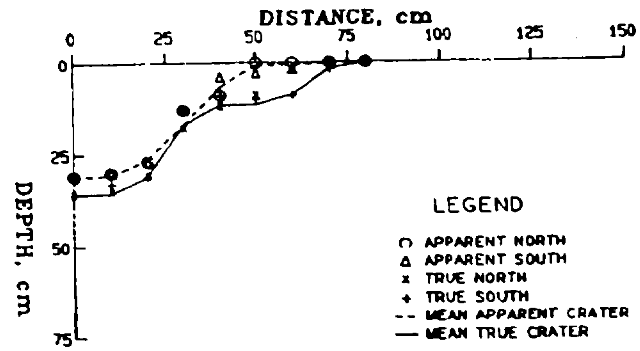
CRATER DATA

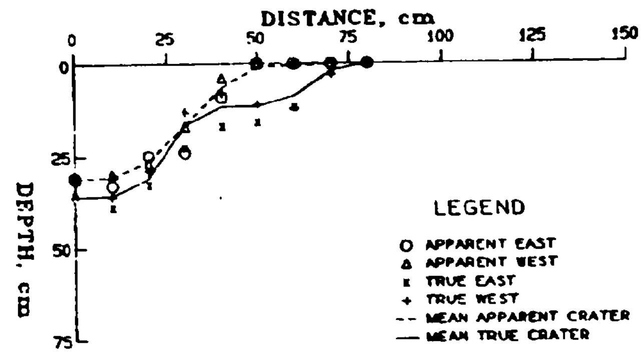
Moisture Content: 8.2

CRATER VOLUMES (M**3):
True Crater: 0.228
Apparent Crater: 0.110
Flow: 0.086

DENSITIES (G/CM**3):
Pre-Shot: 1.50
Post Shot: 1.50

5B C4 15LB 1152HR 5AUG83 61 47M





EVENT SUMMARY DATA

Test Number: HE3B-c (TEST 14)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 045
RANGE (M): 46

Charge Shape: SPHERICAL

Charge Wt: 15.0 LB
Event Time: **:**

METEOROLOGICAL DATA:

Start Time: 11:10 End Time: 11:44

Wind Speed (M/S): 3.4

Wind Direction (DEG): 080

Temperature (C): NO DATA

Relative Humidity (%): NO DATA

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	46.0 045.0	*	*	*	75 *
Post-Shot	47.0 045.0	*	354	670	750+

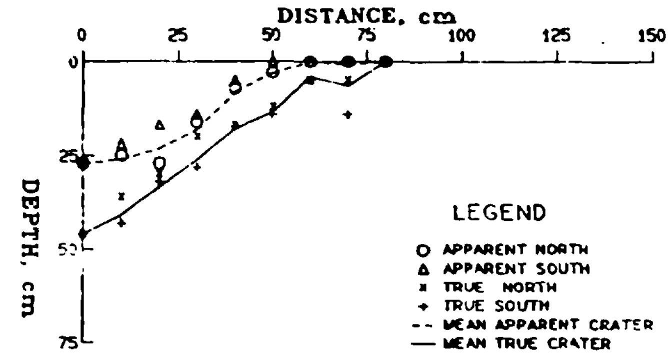
CRATER DATA

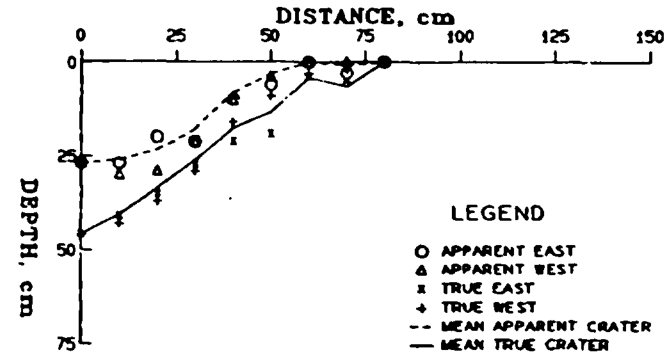
Moisture Content: 5.0

CRATER VOLUMES (M**3):
True Crater: 0.256
Apparent Crater: 0.118
Flow: 0.138

DENSITIES (G/CM**3):
Pre-Shot: 1.71
Post Shot: 1.71

5C C4 15LB 5AUG83 45 46M





EVENT SUMMARY DATA

Test Number: HE6C-a (TEST 15)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 075
RANGE (M): 55

Charge Shape: SPHERICAL

Charge Wt: 25.0 LB
Event Time: 13:35

METEOROLOGICAL DATA:

Start Time: 12:22 End Time: 12:45

Wind Speed (M/S): 2.9

Wind Direction (DEG): 075

Temperature (C): 33.3

Relative Humidity (%): 35

CONE INDEX:

	Range.	Azimuth	SFC	15	30	45
Pre-Shot	55.0	075.0	*	372	678	750+
Post-Shot	55.0	075.0	*	*	*	*

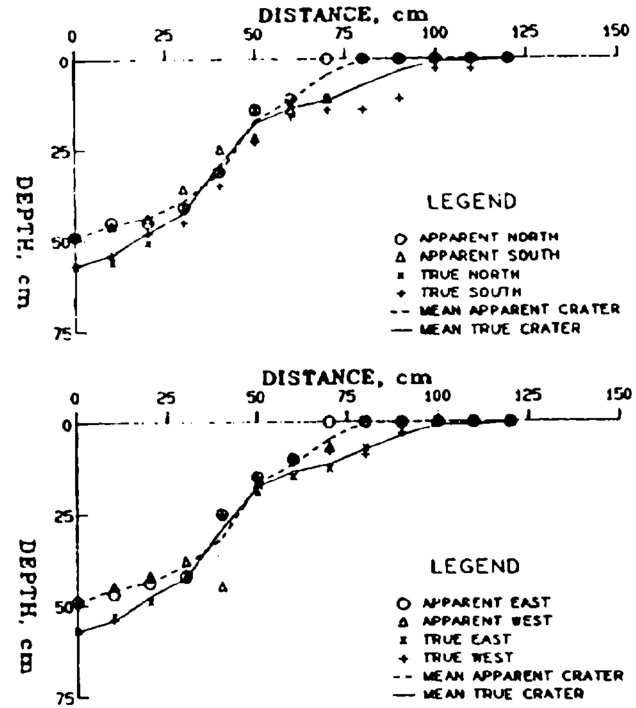
CRATER DATA

Moisture Content: 8.1

CRATER VOLUMES (M**3):
True Crater: 0.481
Apparent Crater: 0.360
Flow: 0.121

DENSITIES (G/CM**3):
Pre-Shot: 1.79
Post Shot: *

6A C4 25LB 1335HR 5AUG83 75 55M



EVENT SUMMARY DATA

Test Number: HE6C-b (TEST 15)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 091
RANGE (M): 51

Charge Shape: SPHERICAL

Charge Wt: 25.0 LB
Event Time: 13:35

METEOROLOGICAL DATA:

Start Time: 12:22 End Time: 12:45

Wind Speed (M/S): 2.9

Wind Direction (DEG): 075

Temperature (C): 33.3

Relative Humidity (%): 35

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	55.0 075.0	*	372	678	750+
Post-Shot	55.0 075.0	*	*	*	*

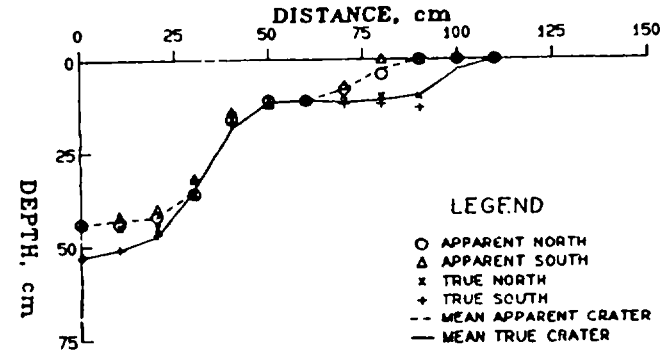
CRATER DATA

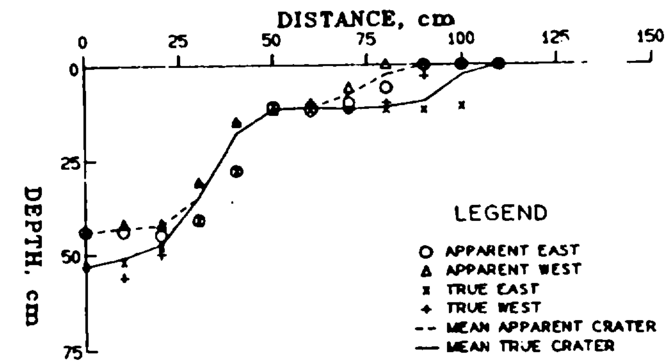
Moisture Content: 8.3

CRATER VOLUMES (M**3):
True Crater: 0.467
Apparent Crater: 0.323
Flow: 0.144

DENSITIES (G/CM**3):
Pre-Shot: 1.62
Post Shot: *

6B C4 25LB 5AUG83 1340HR 91 51M





EVENT SUMMARY DATA

Test Number: HE6C-c (TEST 15)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): •
RANGE (M): •

Charge Shape: SPHERICAL

Charge Wt: 25.0 LB
Event Time: ••:••

METEOROLOGICAL DATA:

Start Time: 12:22 End Time: 12:45

Wind Speed (M/S): 2.5

Wind Direction (DEG): 075

Temperature (C): 33.3

Relative Humidity (%): 35

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	55.0 075.0	•	372	678	750+
Post-Shot	55.0 075.0	•	•	•	•

CRATER DATA

Moisture Content: •

CRATER VOLUMES (M**3):
True Crater: •
Apparent Crater: •
Flow: •

DENSITIES (G/CM**3):
Pre-Shot: •
Post Shot: •

EVENT SUMMARY DATA

Test Number: HE7C (TEST 16)

Surface Tangent

Date: 05 AUGUST 83
Detonation Coordinates :
AZIMUTH (DEG): 090
RANGE (M): 37

Charge Shape: SPHERICAL

Charge Wt: 25.0 LB
Event Time: ••:••

METEOROLOGICAL DATA:

Start Time: 13:15 End Time: 13:30

Wind Speed (M/S): 4.0

Wind Direction (DEG): 075

Temperature (C): NO DATA

Relative Humidity (%): NO DATA

CONE INDEX:

	Range, Azimuth	SFC	15	30	45
Pre-Shot	37.0 090.0	•	258	583	745
Post-Shot	37.0 090.0	•	113	433	595

CRATER DATA

Moisture Content: 11.8

CRATER VOLUMES (M**3):
True Crater: •
Apparent Crater: •
Flow: •

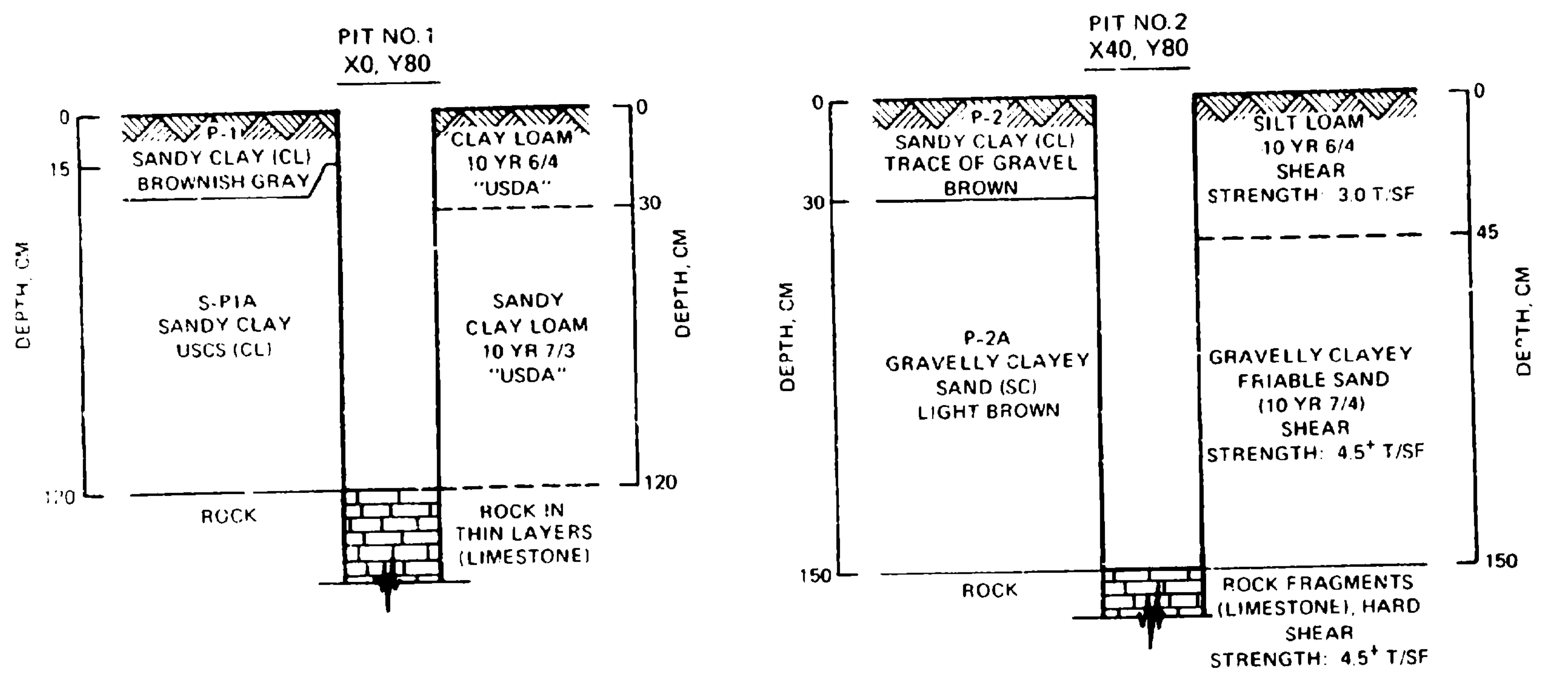
DENSITIES (G/CM**3):
Pre-Shot: •
Post Shot: 1.64

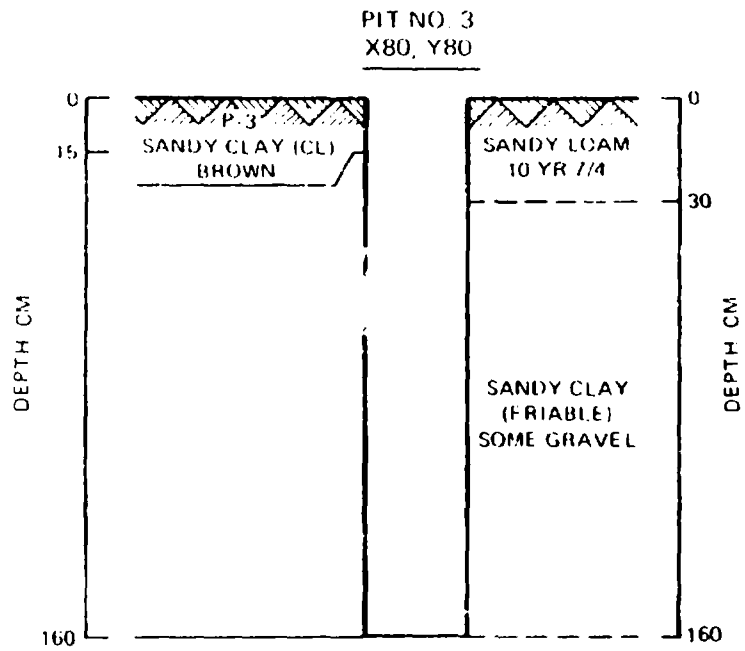
APPENDIX B: SOILS DATA FROM DOT I AND DOT II EXERCISES

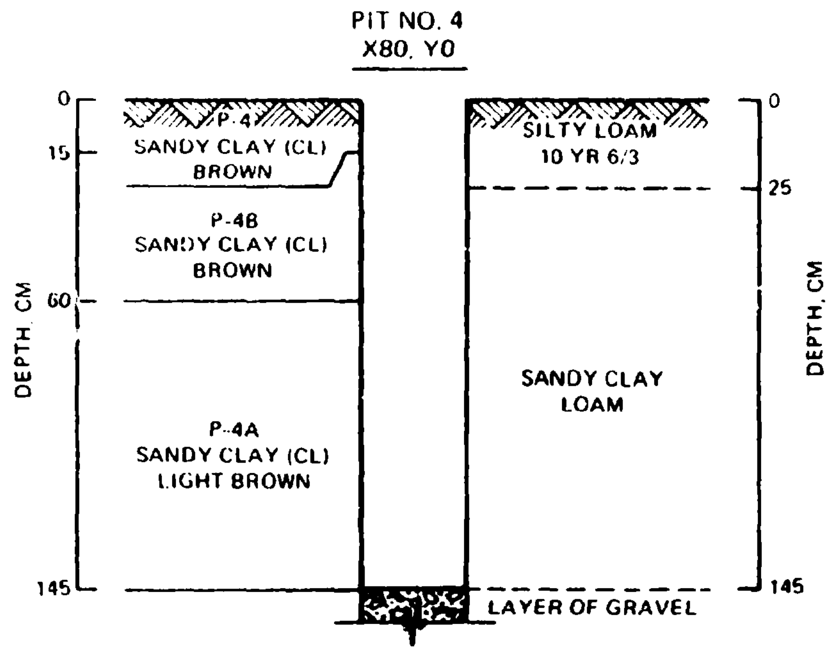
PIT SOIL DATA: DOT I

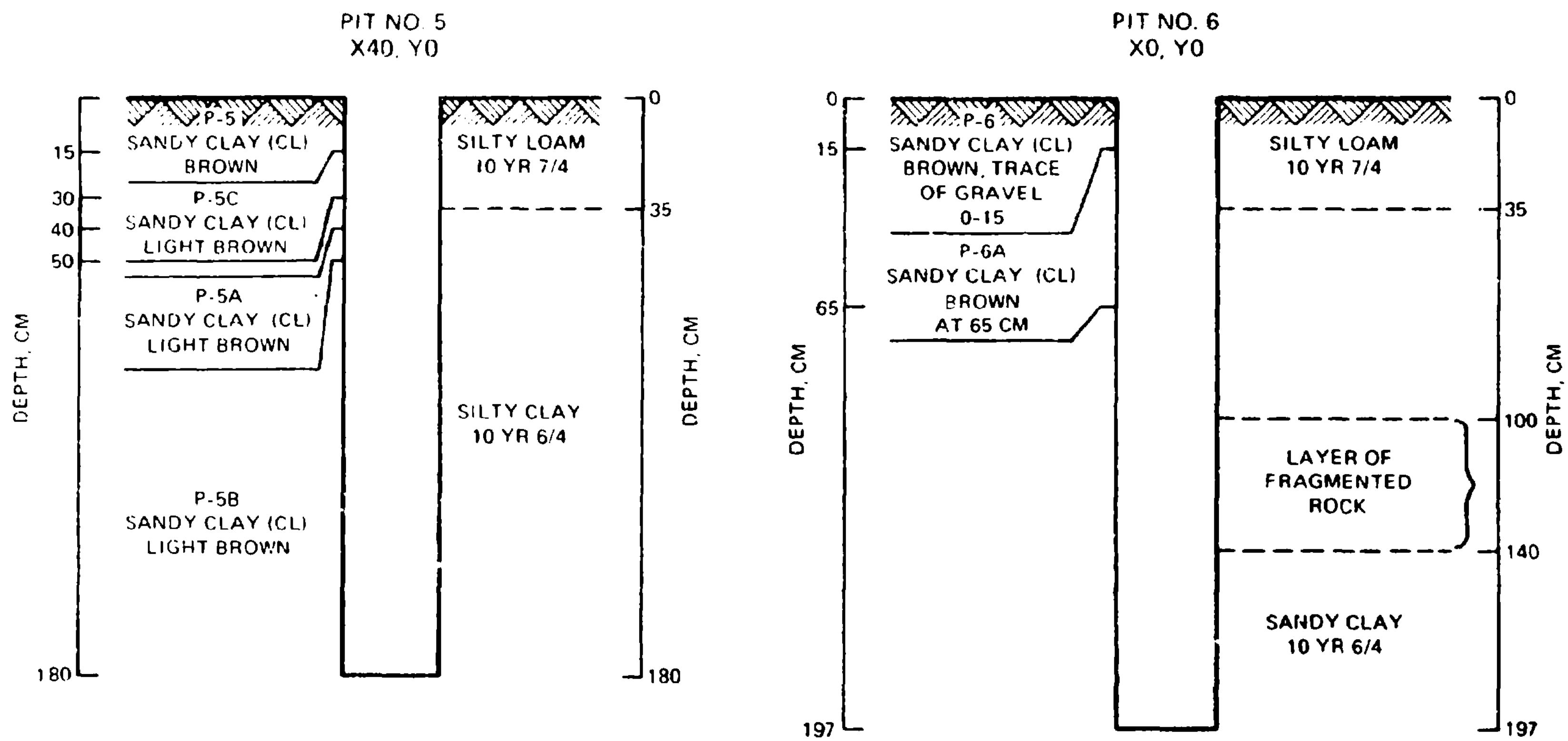
Pit Sample	Date 1983	Locale (m) X	Locale (m) Y	Depth cm	Soil Type USCS	% Finer 0.074um	Density* gm/cc	Organic Matter%	Moisture Content%	Specific Gravity
P1	4-15	0	80	10	CL	71	1.44/1.26	3.6	11.5	2.68
P1A	4-15	0	80	150	CL	64	1.45/1.35	2.2	2.0	2.73
P2	4-15	40	80	10	CL	72	1.69/1.48	2.9	14.1	2.68
P2A	4-15	40	80	150	SC	30	1.57/1.50	1.4	4.9	2.76
P3	4-16	80	80	10	CL	-	1.62/1.45	-	10.3	2.65
P4	4-18	80	0	10	CL	-	1.52/1.34	-	13.4	2.69
P4A	4-18	80	0	145	CL	78	1.51/1.38	2.2	9.4	2.72
P4B	4-18	80	0	60	CL	76	1.49/1.36	2.5	10.8	2.71
P5	4-18	40	0	10	CL	-	1.55/1.40	-	13.8	2.67
P5A	4-18	40	0	40	CL	79	-	2.8	-	2.72
P5B	4-18	40	0	180	CL	81	1.51/1.38	1.7	9.2	2.76
P5C	4-18	40	0	40	CL	-	1.53/1.38	-	10.5	2.69
P6	4-18	0	0	10	CL	-	1.57/1.46	-	7.9	2.68
P6A	4-18	0	0	65	CL	62	1.67/1.53	2.5	8.9	-

* Density wet/density dry.

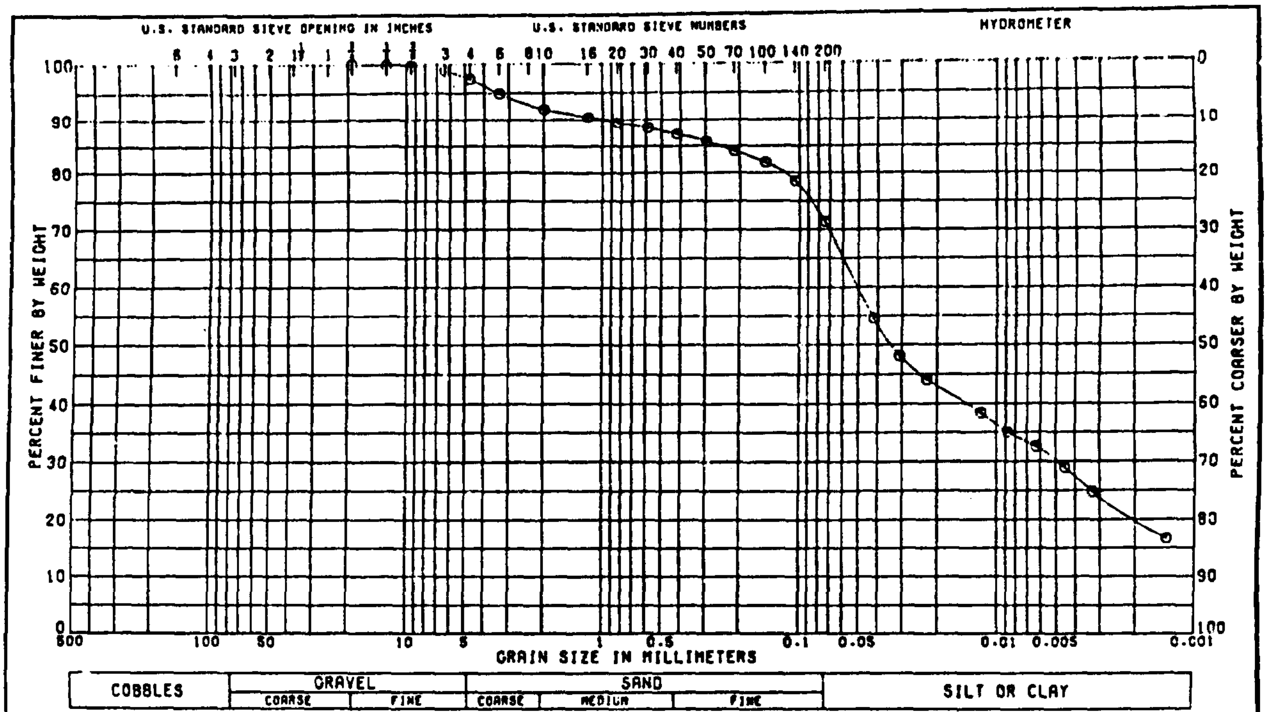

PIT NO.1
X0, Y80
0
15
120
DEPTH, CM
P-1
SANDY CLAY (CL)
BROWNISH GRAY
S-P1A
SANDY CLAY
USCS (CL)
ROCK
CLAY LOAM
10 YR 6/4
"USDA"
SANDY
CLAY LOAM
10 YR 7/3
"USDA"
ROCK IN
THIN LAYERS
(LIMESTONE)
0
30
120
DEPTH, CM
PIT NO.2
X40, Y80
0
30
150
DEPTH, CM
P-2
SANDY CLAY (CL)
TRACE OF GRAVEL
BROWN
P-2A
GRAVELLY CLAYEY
SAND (SC)
LIGHT BROWN
ROCK
SILT LOAM
10 YR 6/4
SHEAR
STRENGTH: 3.0 T/SF
GRAVELLY CLAYEY
FRIABLE SAND
(10 YR 7/4)
SHEAR
STRENGTH: 4.5+ T/SF
ROCK FRAGMENTS
(LIMESTONE), HARD
SHEAR
STRENGTH: 4.5+ T/SF
0
45
150
DEPTH, CM


PIT NO. 3
X80, Y80
P-3
SANDY CLAY (CL)
BROWN
SANDY LOAM
10 YR 7/4
SANDY CLAY
(FRIABLE)
SOME GRAVEL
DEPTH CM
0
15
30
160


PIT NO. 4
X80, Y0
P-4
SANDY CLAY (CL)
BROWN
P-4B
SANDY CLAY (CL)
BROWN
P-4A
SANDY CLAY (CL)
LIGHT BROWN
SILTY LOAM
10 YR 6/3
SANDY CLAY
LOAM
LAYER OF GRAVEL
DEPTH, CM
0
15
25
60
145



PIT NO. 5
X40, Y0
P-5
SANDY CLAY (CL)
BROWN
P-5C
SANDY CLAY (CL)
LIGHT BROWN
P-5A
SANDY CLAY (CL)
LIGHT BROWN
P-5B
SANDY CLAY (CL)
LIGHT BROWN
15
30
40
50
180
DEPTH, CM
SILTY LOAM
10 YR 7/4
SILTY CLAY
10 YR 6/4
0
35
180
DEPTH, CM
PIT NO. 6
X0, Y0
P-6
SANDY CLAY (CL)
BROWN, TRACE
OF GRAVEL
0-15
P-6A
SANDY CLAY (CL)
BROWN
AT 65 CM
0
15
65
197
DEPTH, CM
SILTY LOAM
10 YR 7/4
LAYER OF
FRAGMENTED
ROCK
SANDY CLAY
10 YR 6/4
0
35
100
140
197
DEPTH, CM

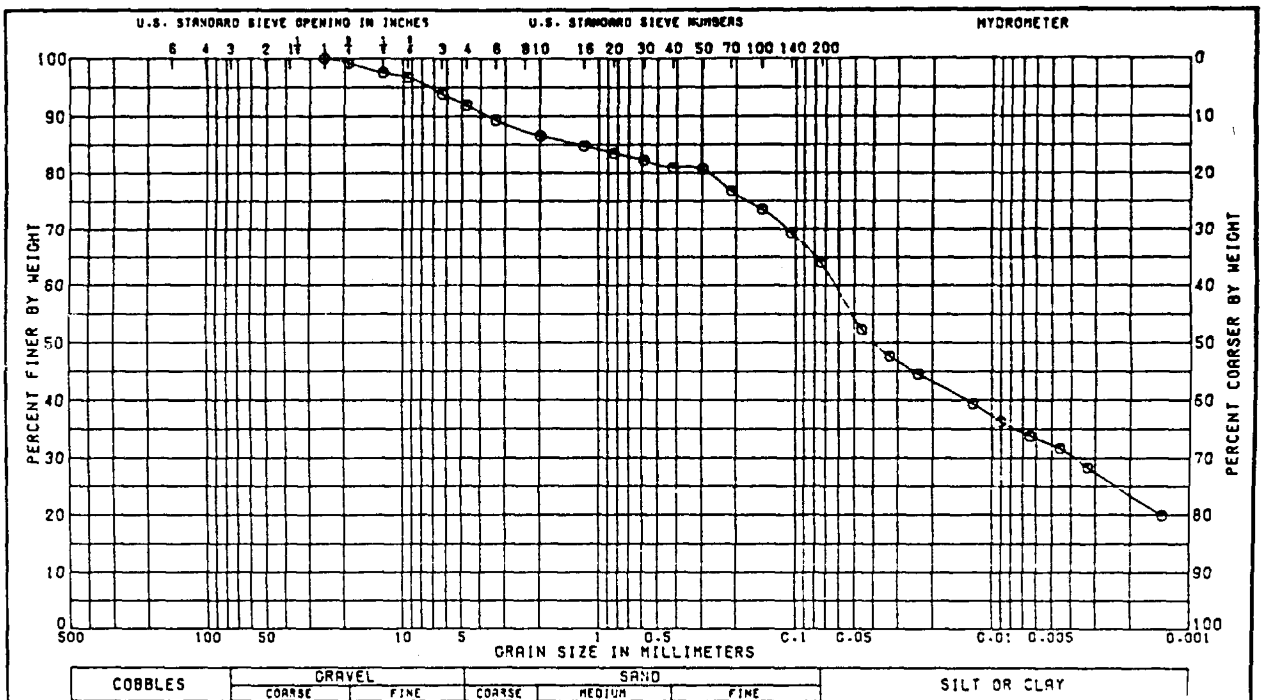


LL 31 | PL 20 | PI 11 | GS 2.68 | NAT W.% | ORG CONT 3.6%

CLASSIFICATION
SANDY CLAY (CL), BROWNISH GRAY

PROJECT DOT FORT CARSON, CO. DOT I
XO-Y80
BORING NO. P-1 SAMPLE NO. 0
DEPTH/ELEV 0-15 DATE 17 AUG 83
Taken: 12-28 Apr 83

GRADATION CURVE

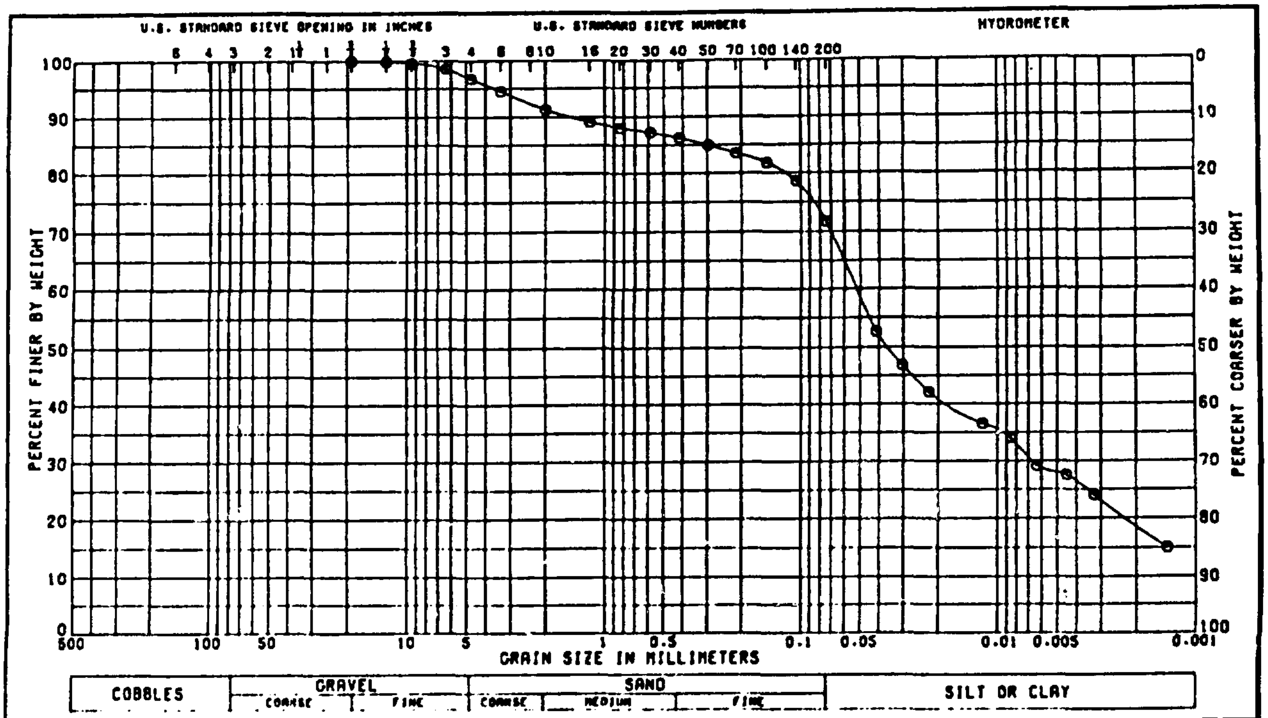


LL 30 | PL 14 | PI 16 | GS 2.73 | NAT W.% | ORG. CONT. 2.2%

CLASSIFICATION
SANDY CLAY (CL), BROWN: WITH GRAVEL

PROJECT DOT FORT CARSON, CO. DOT I
XO.Y80
BORING NO. P-1A SAMPLE NO. 0
DEPTH/ELEV 150CM DATE 17 AUG 83

GRADATION CURVE



LL 31	PL 18	PI 13	GS 2.68	NAT W.%	ORG. CONT. 2.9%

CLASSIFICATION

SANDY CLAY (CL), BROWN; TRACE OF GRAVEL

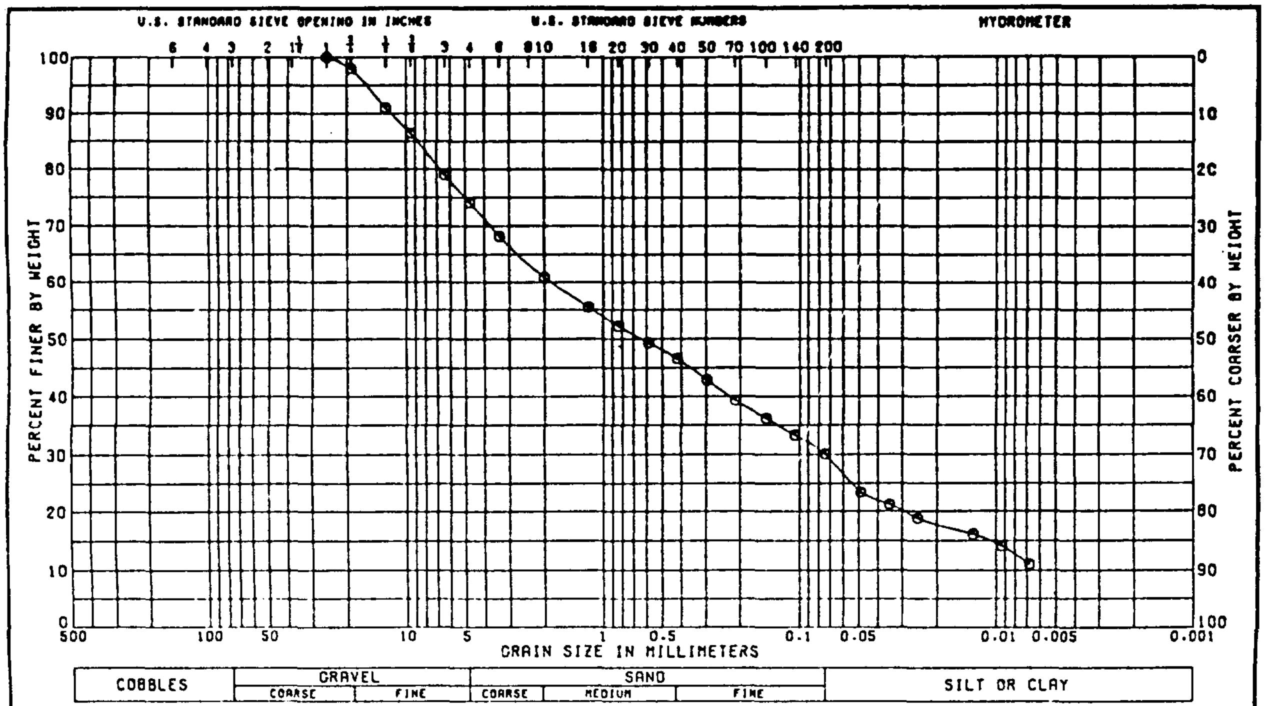
GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I

X40, Y80

BORING NO. P-2 SAMPLE NO. 0

DEPTH/ELEV 0-30 DATE 17 AUG 83



LL 28	PL 16	PI 12	GS 2.76	NAT W.%	ORG. CONT. 1.[illegible]%

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), LIGHT BROWN

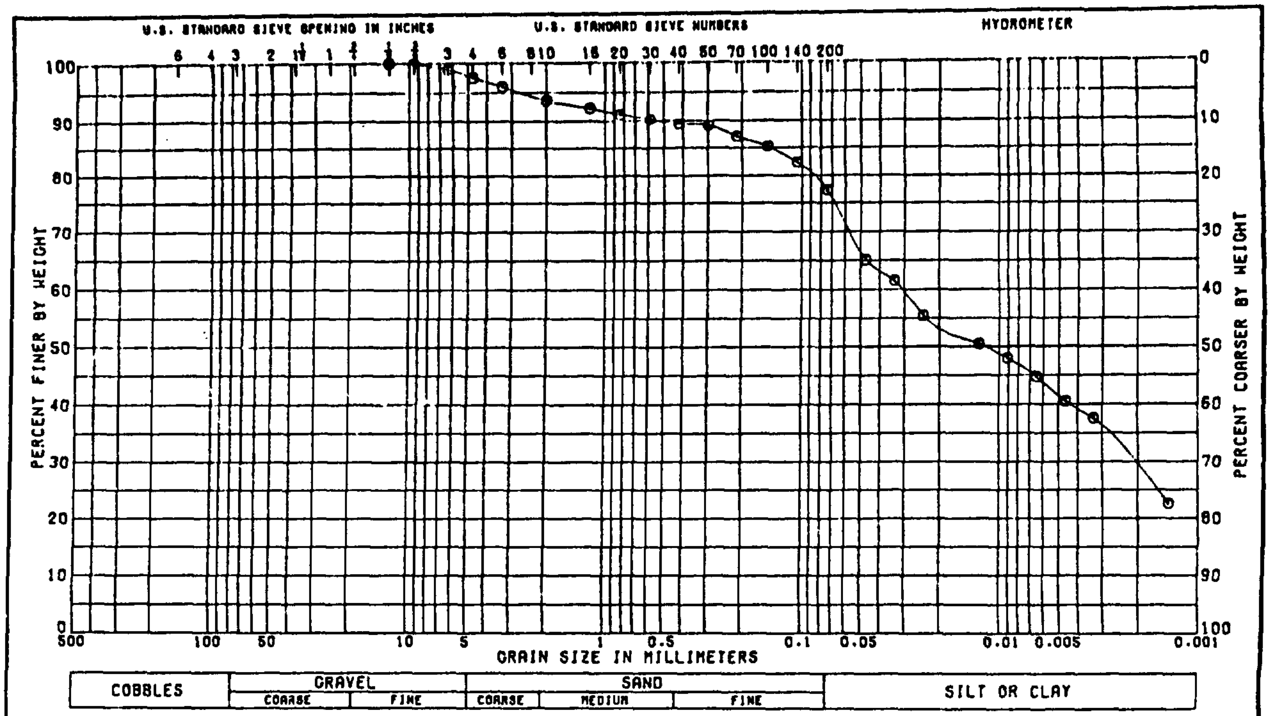
GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I

X40, Y80

BORING NO. P-2A SAMPLE NO. 0

DEPTH/ELEV 150 DATE 17 AUG 83



LL 30	PL 15	PI 15	GS 2.72	NAT W.%	ORG. CONT. 2.2%

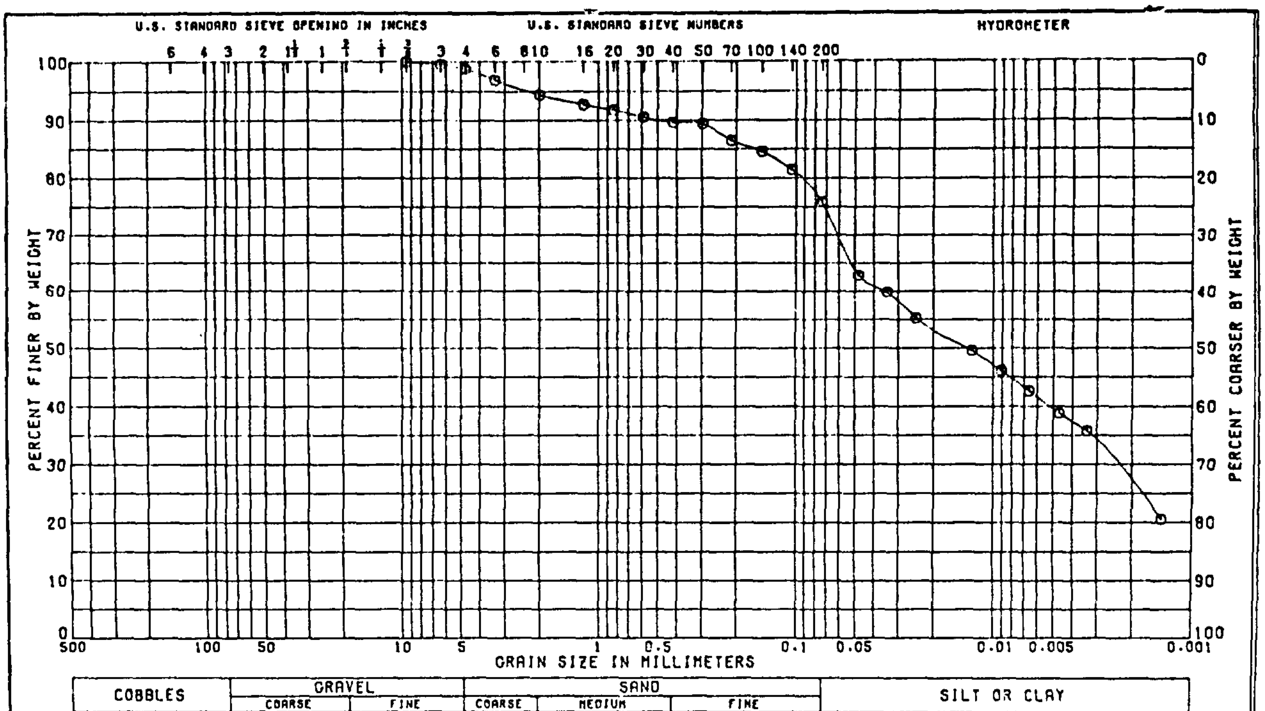
CLASSIFICATION
SANDY CLAY (CL), LIGHT BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I
X80, YO

BORING NO. P-4A SAMPLE NO. 0

DEPTH/ELEV 145 DATE 17 AUG 83



LL 33	PL 17	PI 16	GS 2.71	NAT W.%	ORG. CONT. 2.5%

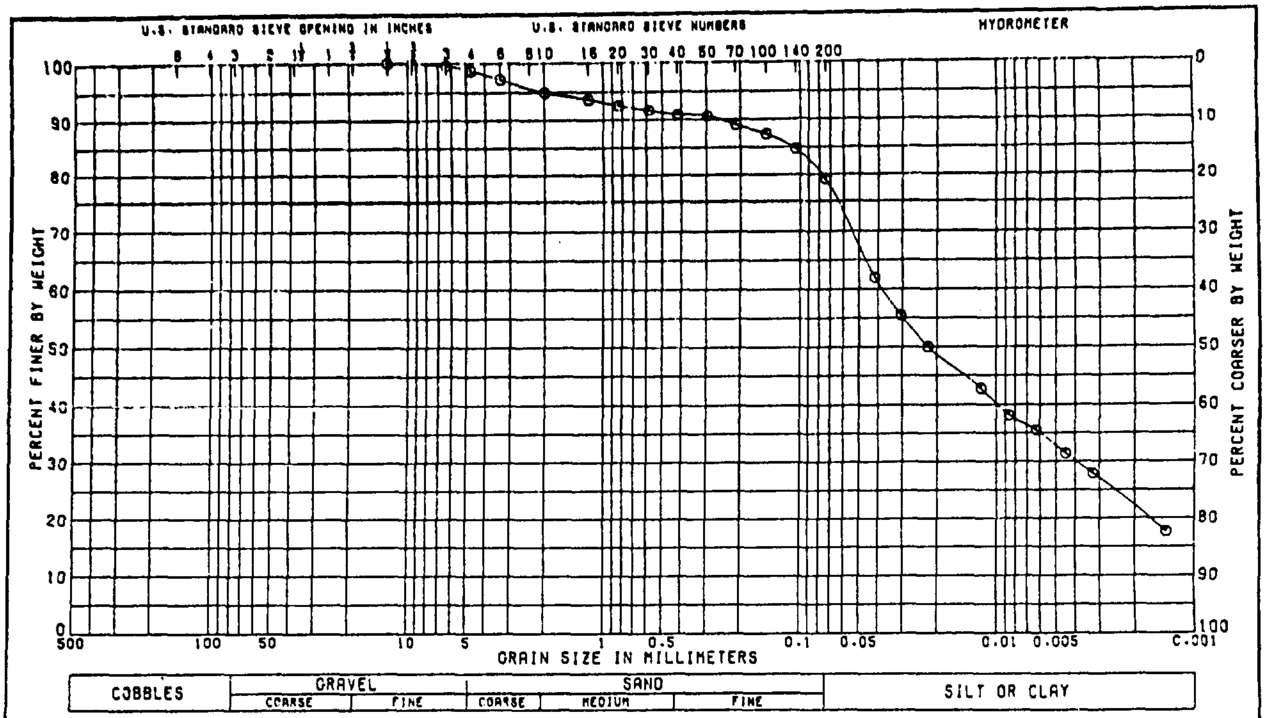
CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I
X80, YO

BORING NO. P-4B SAMPLE NO. 0

DEPTH/ELEV 60 DATE 17 AUG 83



LL 34	PL 18	PI 16	GS 2.72	NAT W.%	ORG. CONT. 2.8%

CLASSIFICATION

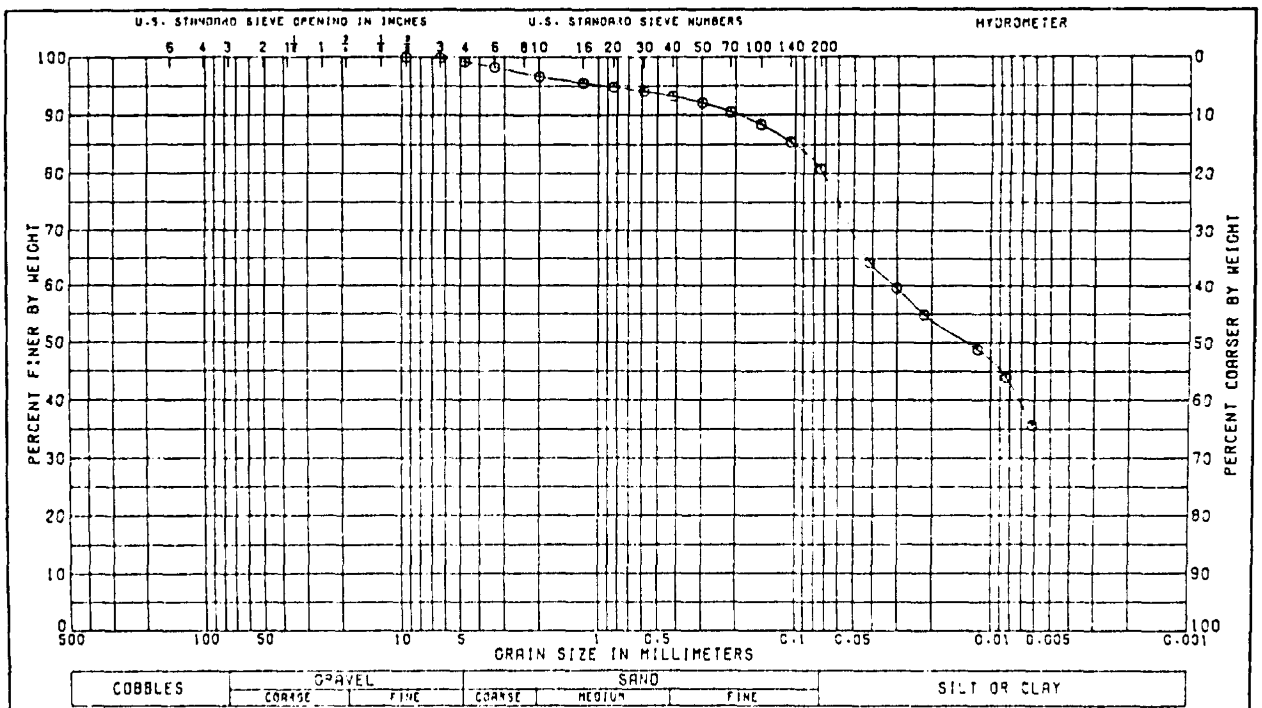
SANDY CLAY (CL), LIGHT BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I
X40, Y0

BORING NO. P-5A SAMPLE NO. 0

DEPTH/ELEV 40-50 DATE 17 AUG 83



LL 28	PL 15	PI 13	GS 2.76	NAT W.%	ORG. CONT. 1.7%

CLASSIFICATION

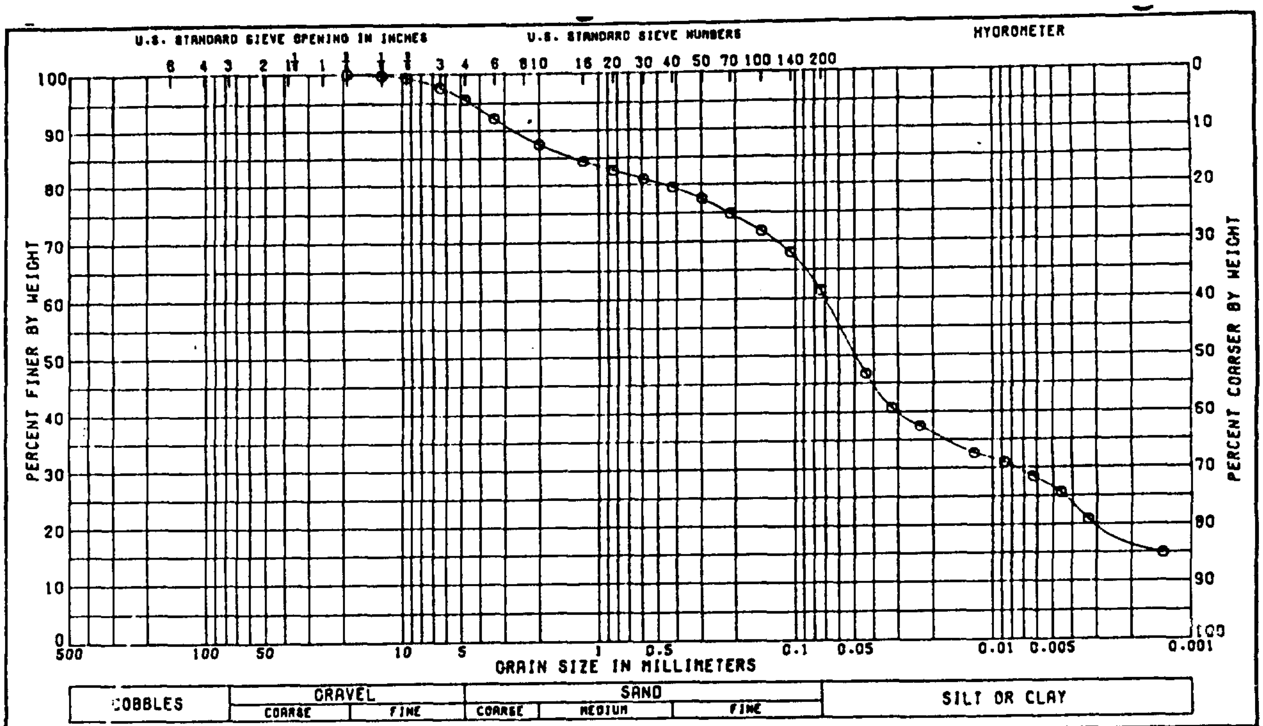
SANDY CLAY (CL), LIGHT BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I
X40, Y0

BORING NO. P-5B SAMPLE NO. 0

DEPTH/ELEV 180 DATE 17 AUG 83



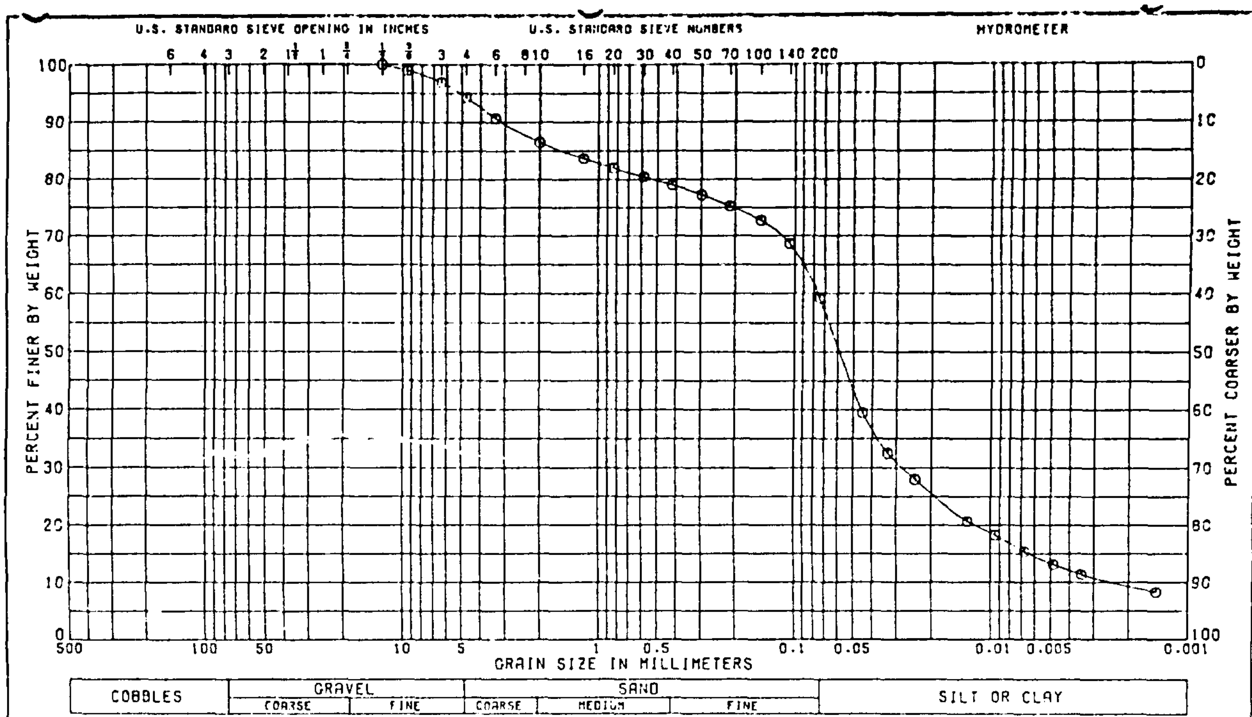
LL 29	PL 16	PI 13	GS 2.72	NAT W.%	ORG. CONT. 2.5%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO. DOT I
X0, Y0

BORING NO. P-6A SAMPLE NO. 0
DEPTH/ELEV 6S DATE 17 AUG 83



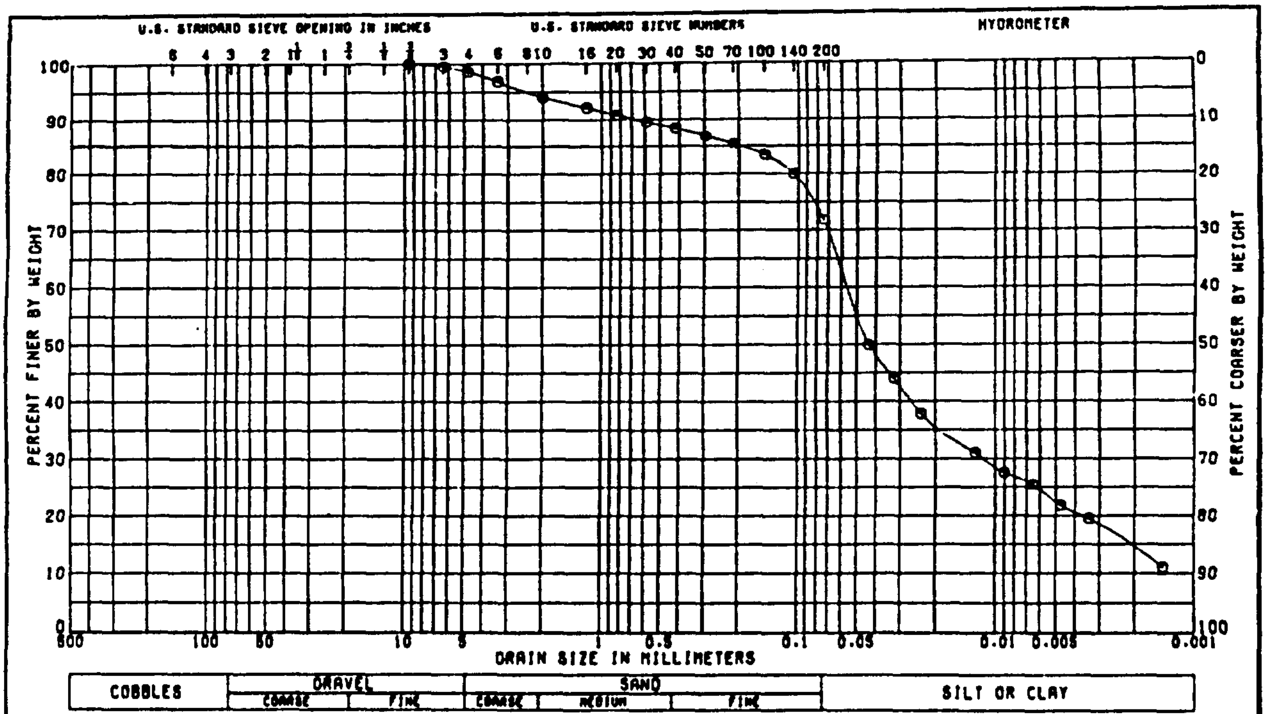
LL 25	PL 20	PI 5	GS 2.66	NAT W.%	ORG. CONT. 3.7%

CLASSIFICATION
SANDY CLAYEY SILT (CL-ML), BROWNISH GRAY: WITH GRAVEL

GRADATION CURVE

PROJECT DOT FORT CARSON, CO DOT I
X65, Y17

BORING NO. HE-C8B SAMPLE NO. 0
DEPTH/ELEV SURFACE DATE 19 AUG 83



LL 28	PL 20	PI 8	GS 2.64	NAT W.%	ORG. CONT. 3.8%

CLASSIFICATION

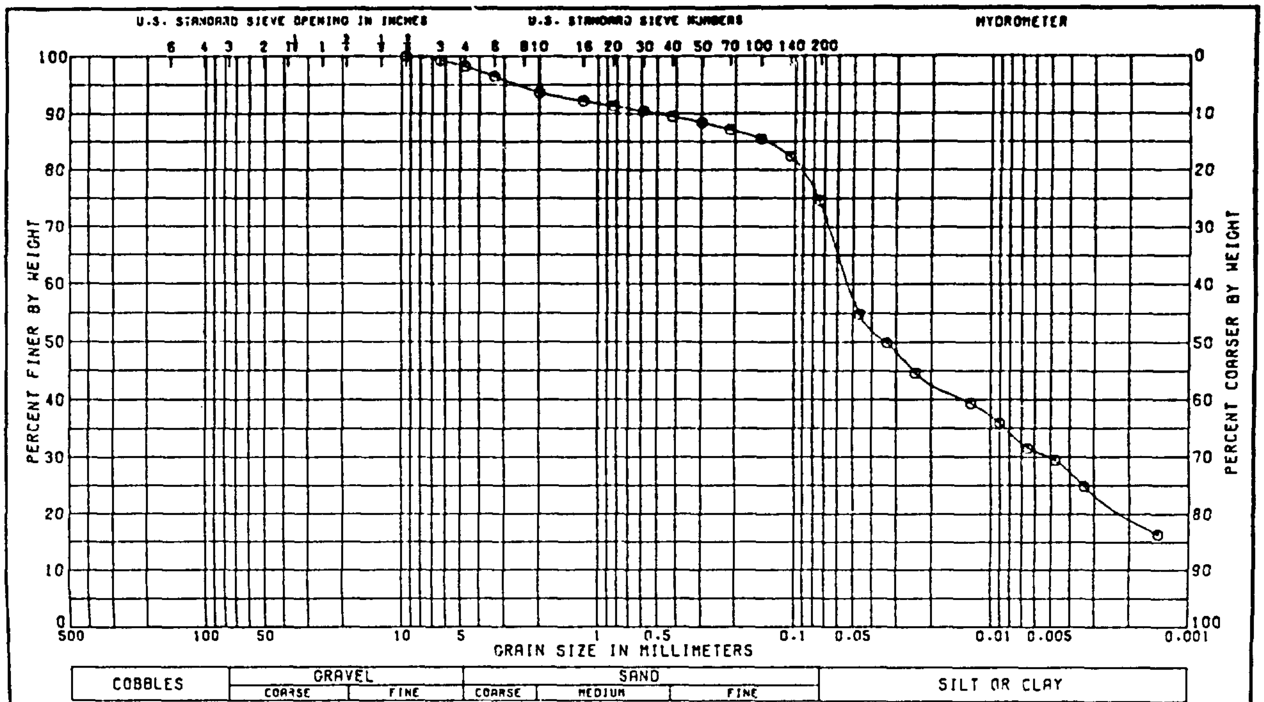
SANDY CLAY (CL), BROWNISH GRAY

GRADATION CURVE

PROJECT DOT. FORT CARSON, CO. DOT I
X43, Y18

BORING NO. HE-810A SAMPLE NO. 0

DEPTH/ELEV SURFACE RIM/EJECTA DATE 19 AUG 83
TAKEN 23 Apr 83



LL 34	PL 17	PI 17	GS 2.68	NAT W.%	ORG. CONT. 3.2%

CLASSIFICATION

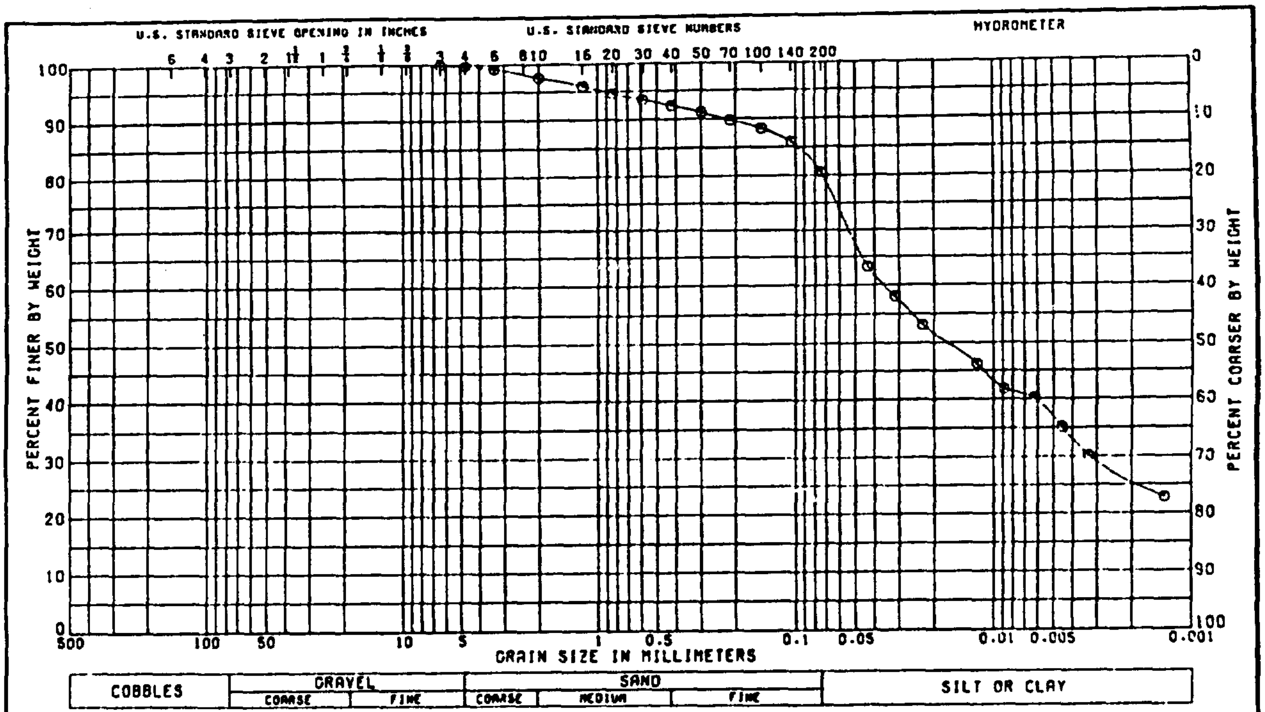
SANDY CLAY (CL), BROWNISH GRAY

GRADATION CURVE

PROJECT DOT. FORT CARSON, CO. DOT I
X36, Y3

BORING NO. HE-81S SAMPLE NO. 0

DEPTH/ELEV SIDE(45cm) DATE 19 AUG 83
Apr 83



LL 40	PL 17	PI 23	GS 2.70	NAT W.%	ORG. CONT. 4.1%

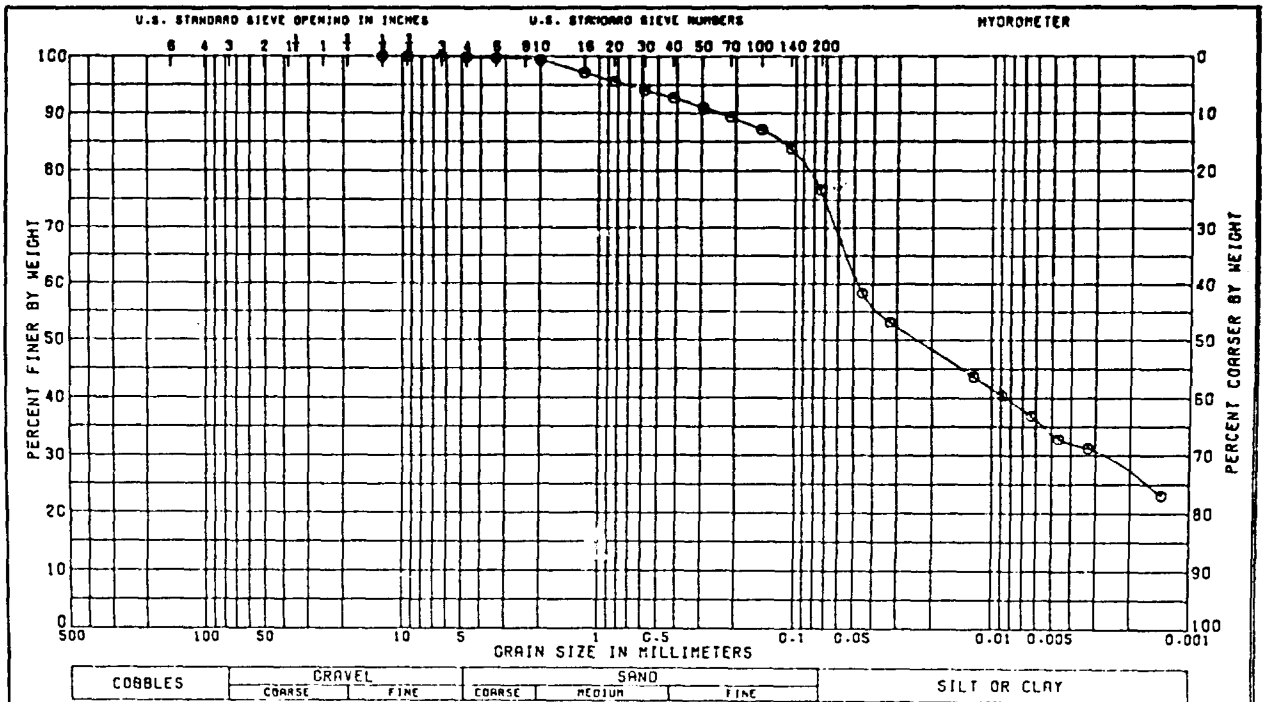
CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT FORT CARSON, CO DOT I
X36, Y3

BORING NO. HE-B15A SAMPLE NO. 0

DEPTH/ELEV 88CM DATE 19 AUG 83
Apr 83



LL 33	PL 16	PI 17	GS 2.70	NAT W.%	ORG. CONT. 2.5%

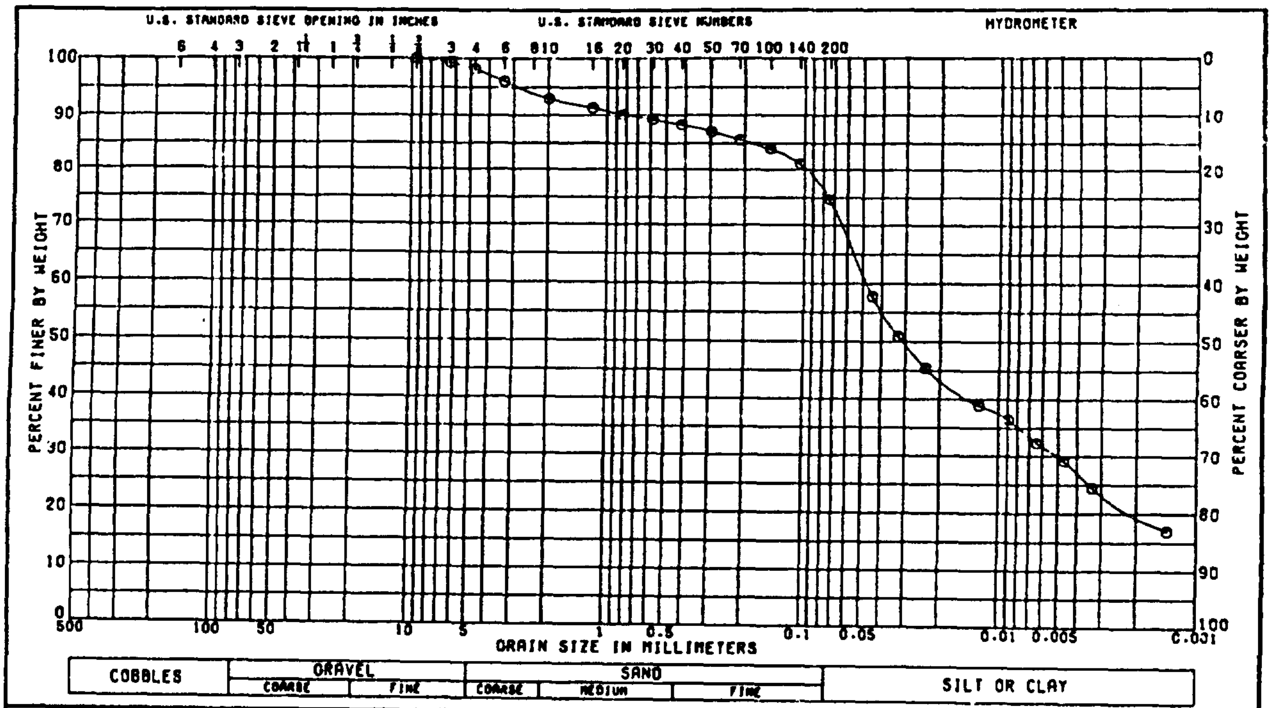
CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X51, Y11

BORING NO. HE-B13 SAMPLE NO. 0

DEPTH/ELEV BOTTOM (94cm) DATE 19 AUG 83
Apr 83

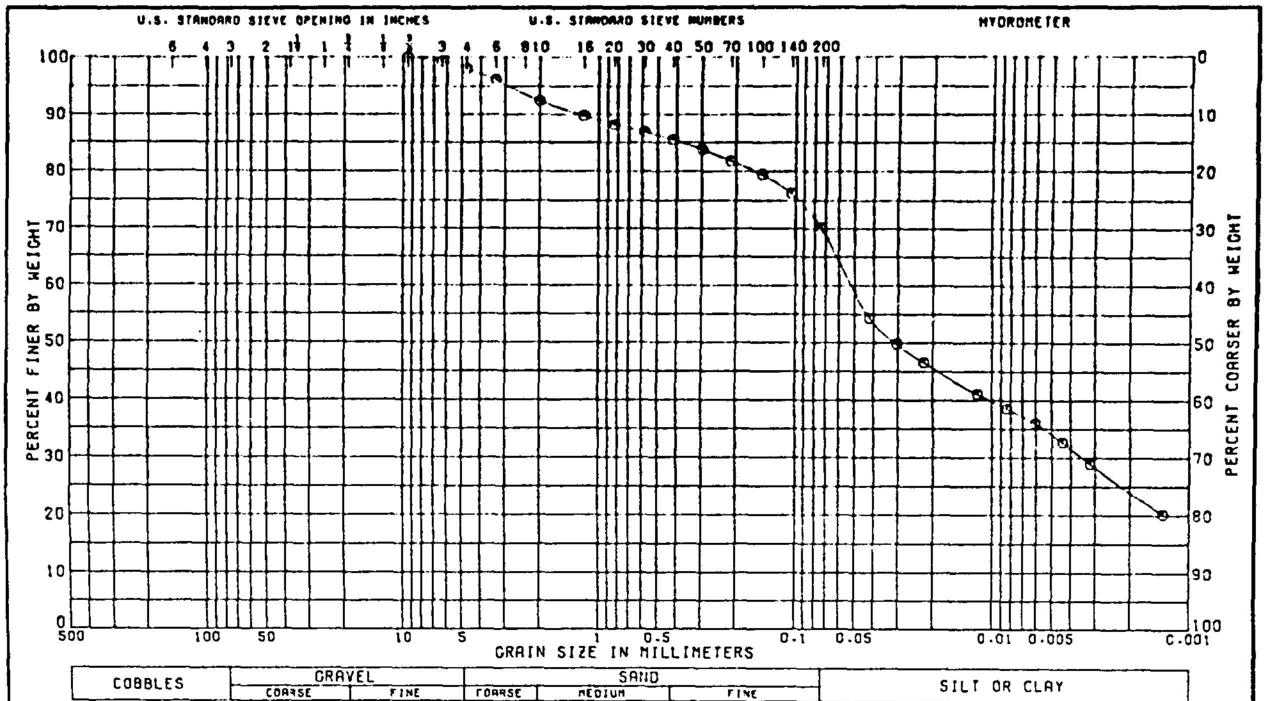


LL 31	PL 16	PI 15	GS 2.70	NAT W.%	ORG. CONT. 2.6%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X70, Y66
BORING NO. HE-A6 SAMPLE NO. 0
DEPTH/ELEV BOTTOM(41cm) DATE 19 AUG 83
Apr 83

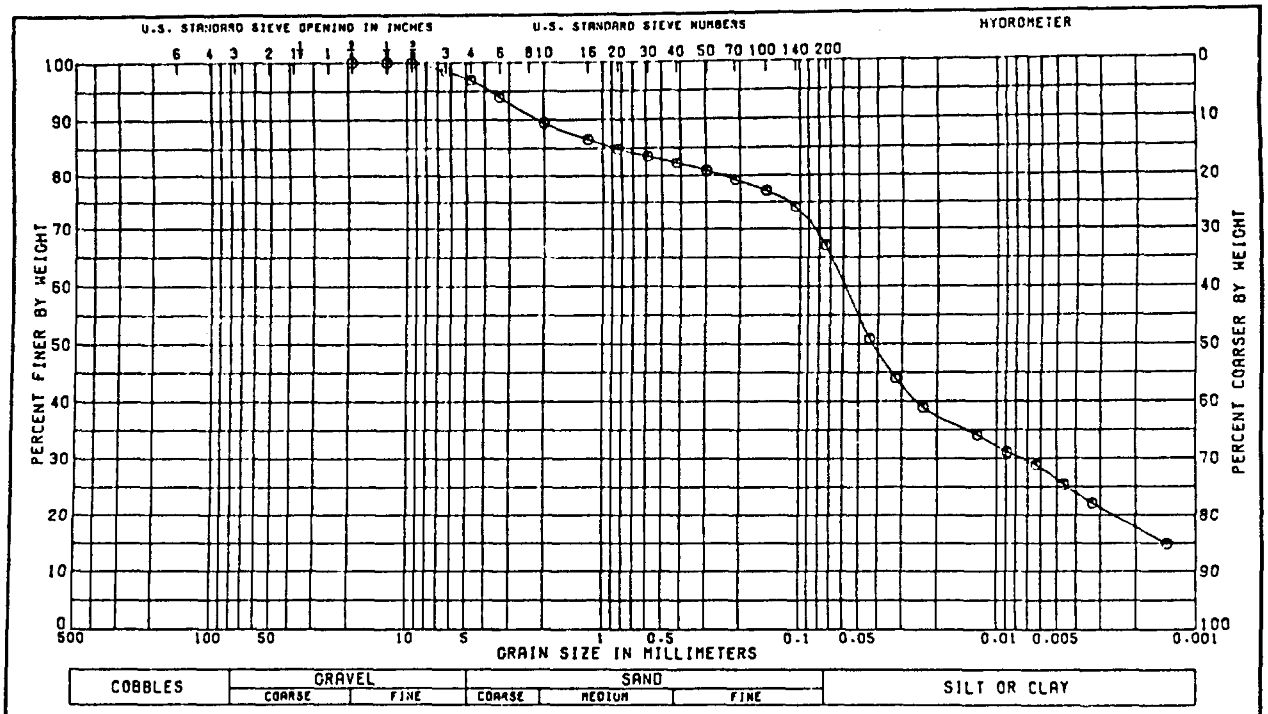


LL 33	PL 14	PI 19	GS 2.71	NAT W.%	ORG. CONT. 2.0%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X55, Y19
BORING NO. HE-B8 SAMPLE NO. 0
DEPTH/ELEV 68-78CM DATE 19 AUG 83
Apr 83



LL 30 | PL 16 | PI 14 | GS 2.72 | NAT W.% | ORG. CONT. 1.82

CLASSIFICATION

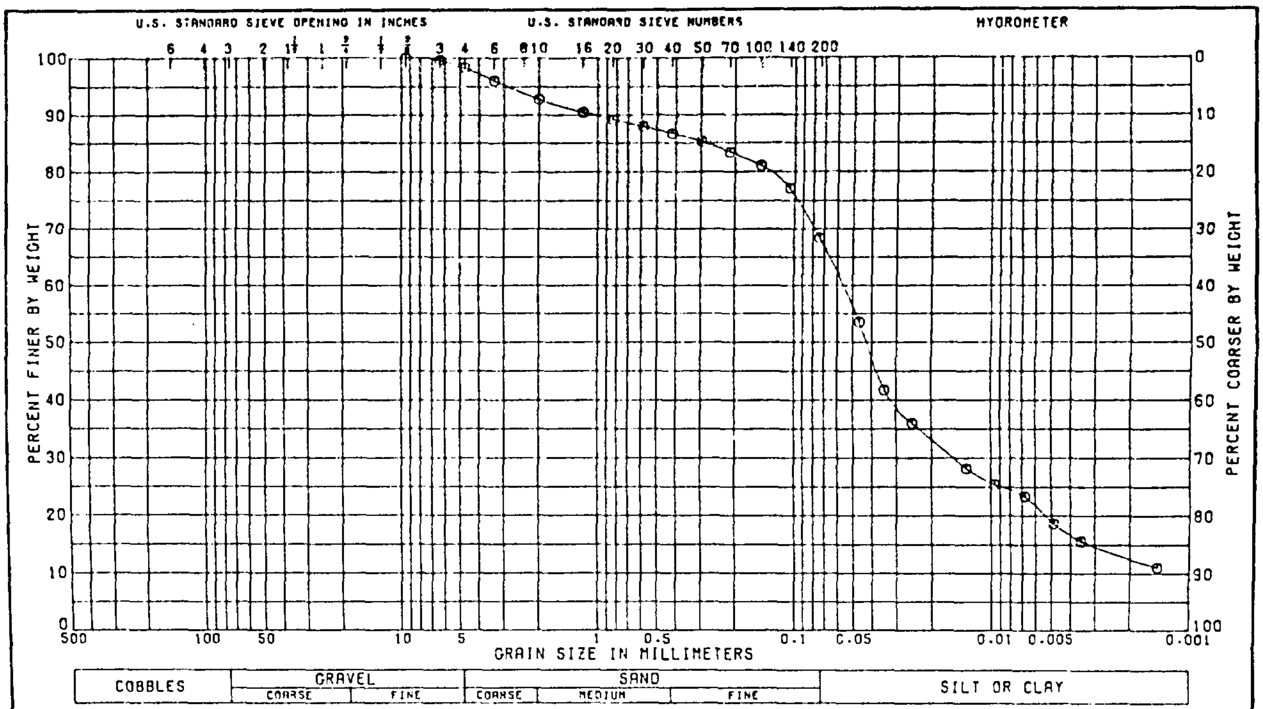
SANDY CLAY (CL), BROWNISH GRAY: TRACE OF GRAVEL

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X65, Y17

BORING NO. E-C8C SAMPLE NO. 0

DEPTH/ELEV BOTTOM (76cm) DATE 19 AUG 83
Apr 83



LL 27 | PL 19 | PI 8 | GS 2.66 | NAT W.% | ORG. CONT. 4.5%

CLASSIFICATION

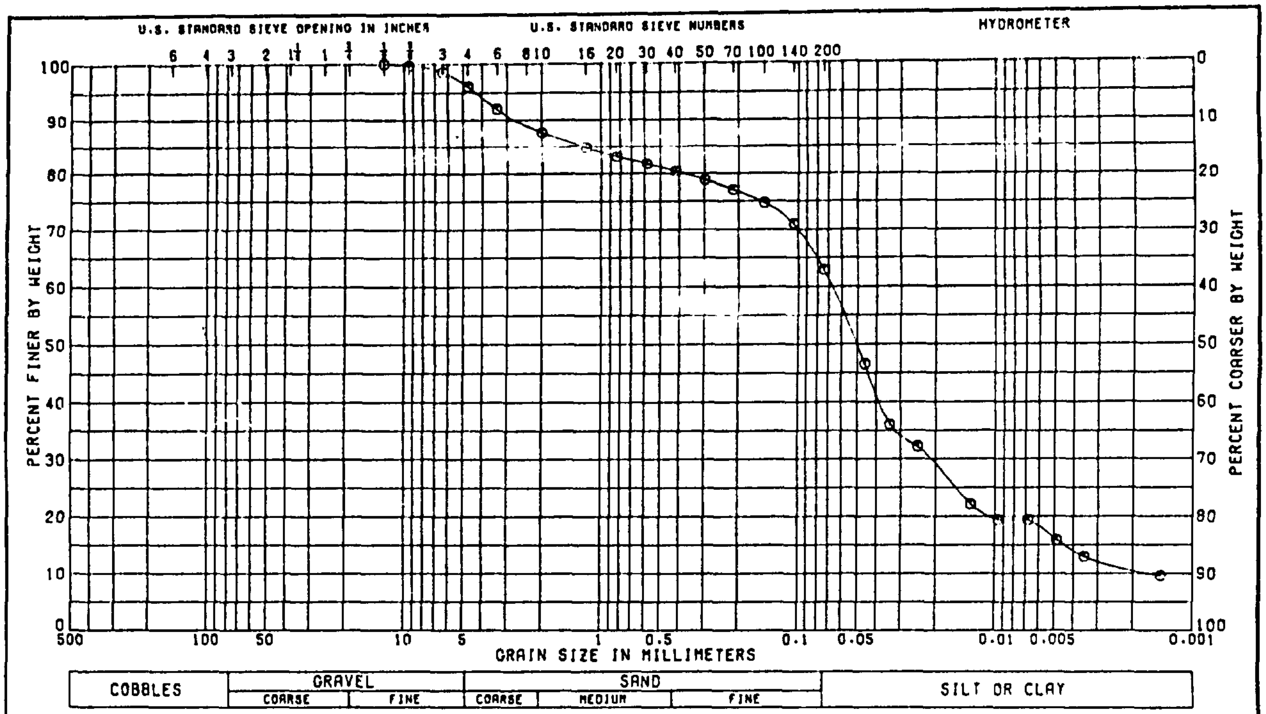
SANDY CLAY (CL), BROWNISH GRAY

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X39, Y9

BORING NO. HE-B11B SAMPLE NO. 0

DEPTH/ELEV RIM/EJECTA SURFACE DATE 19 AUG 83
26 Apr 83

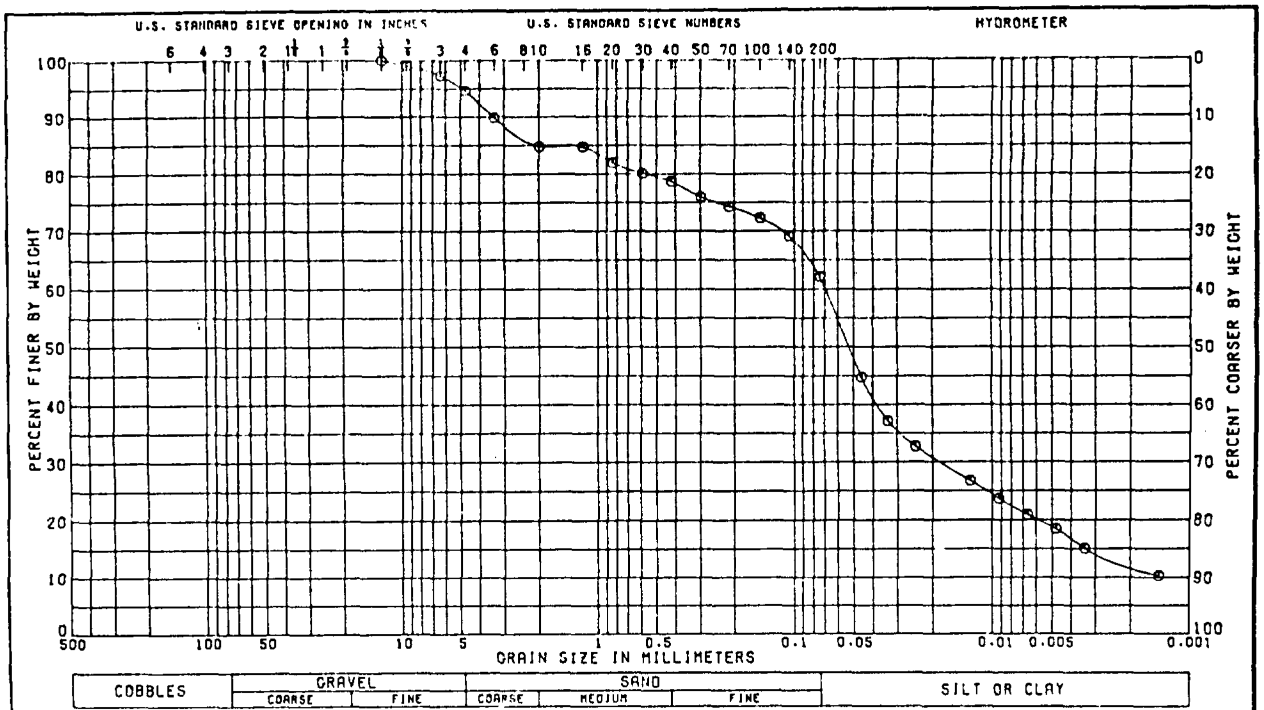


LL 28	PL 17	PI 11	GS 2.66	NAT W.%	ORG.CONT. 4.57

CLASSIFICATION
SANDY CLAY (CL), DARK BROWN: TRACE OF GRAVEL

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X39, Y9
BORING NO. HE-B11A SAMPLE NO. 0
DEPTH/ELEV SURFACE SURE/EJECTA DATE 19 AUG 83
26 Apr 83

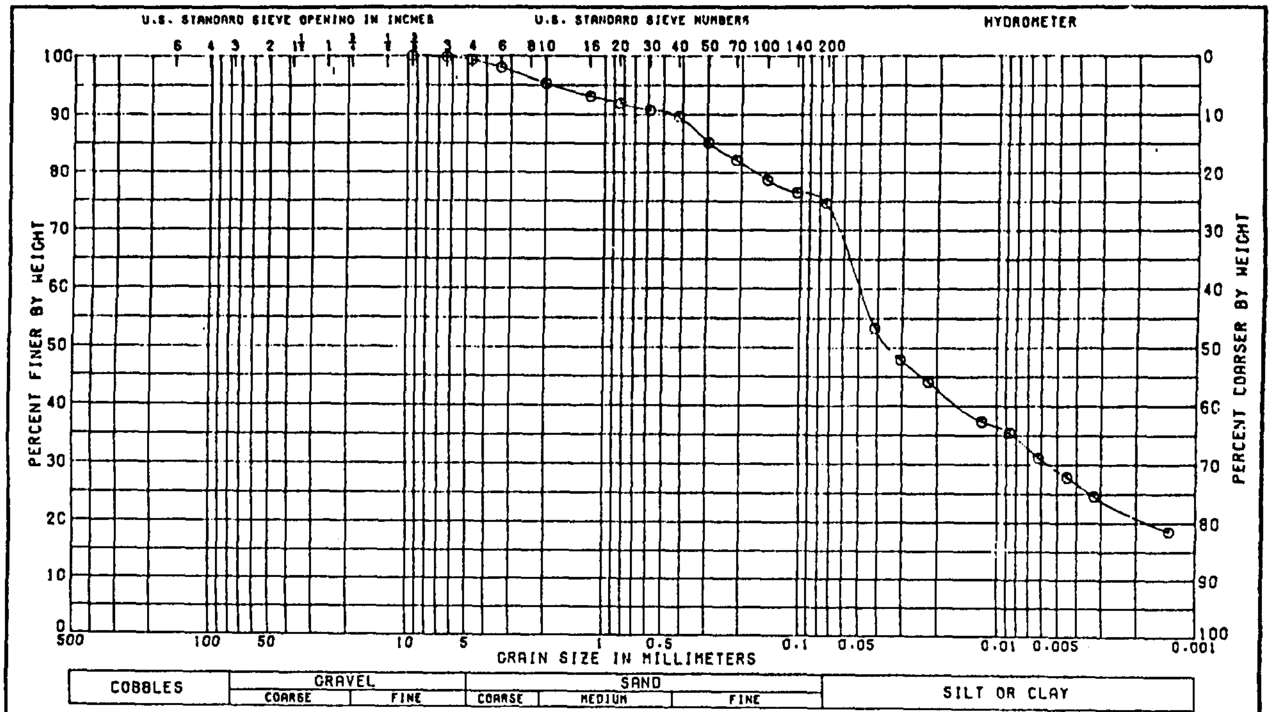


LL 26	PL 17	PI 9	GS 2.66	NAT W.%	ORG. CONT. 4.1%

CLASSIFICATION
SANDY CLAY (CL), BROWNISH GRAY

GRADATION CURVE

PROJECT DOT. FORT CARSON. CO. DOT I
X51, Y11
BORING NO. HE-B13A SAMPLE NO. 0
DEPTH/ELEV SURFACE RIM/EJECTA DATE 19 AUG 83
23 Apr 83



LL	PL	PI	GS	NAT W.%	ORG. CONT.
32	15	17	2.69		3.9%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT, FORT CARSON, CO. DOT I 4-26-84
X39, Y9

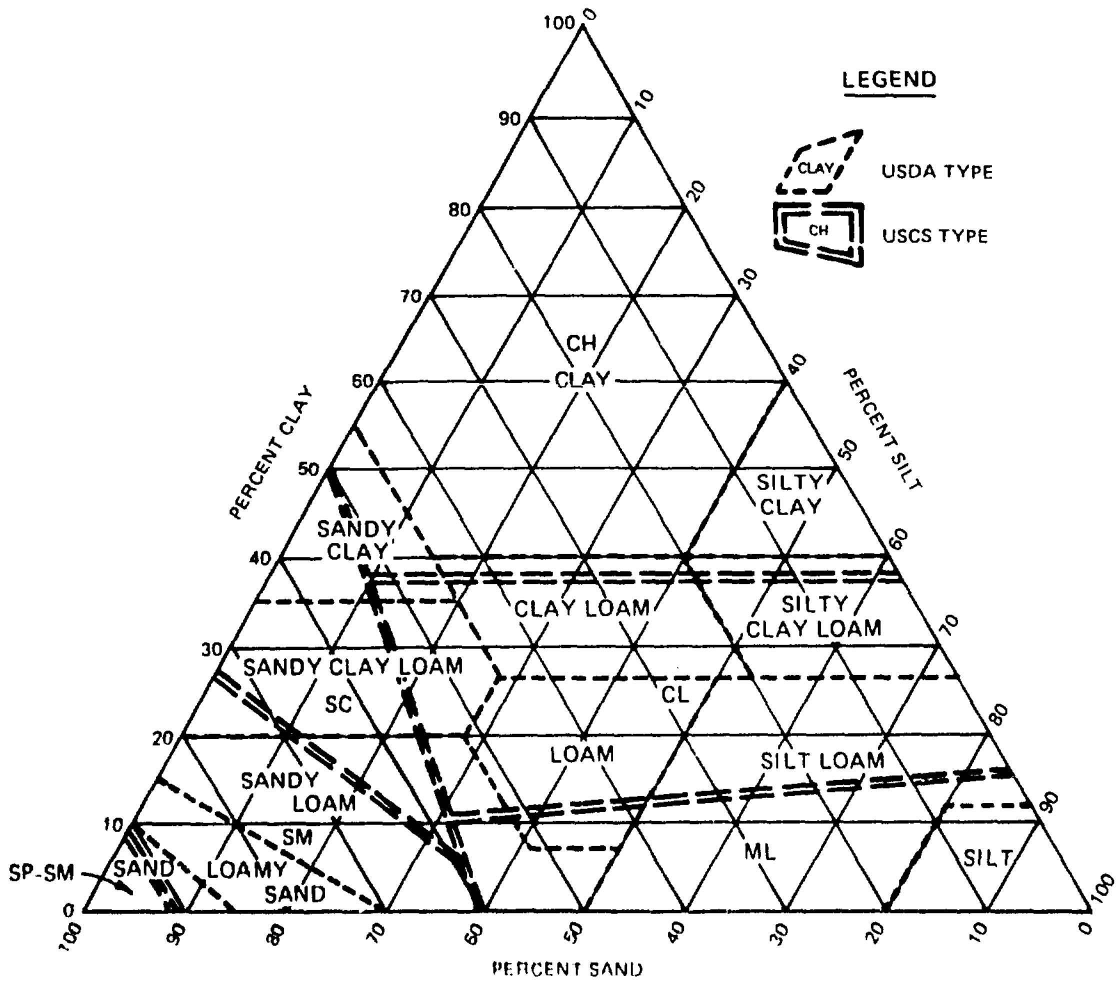
BORING NO. HE-B11 SAMPLE NO. 0

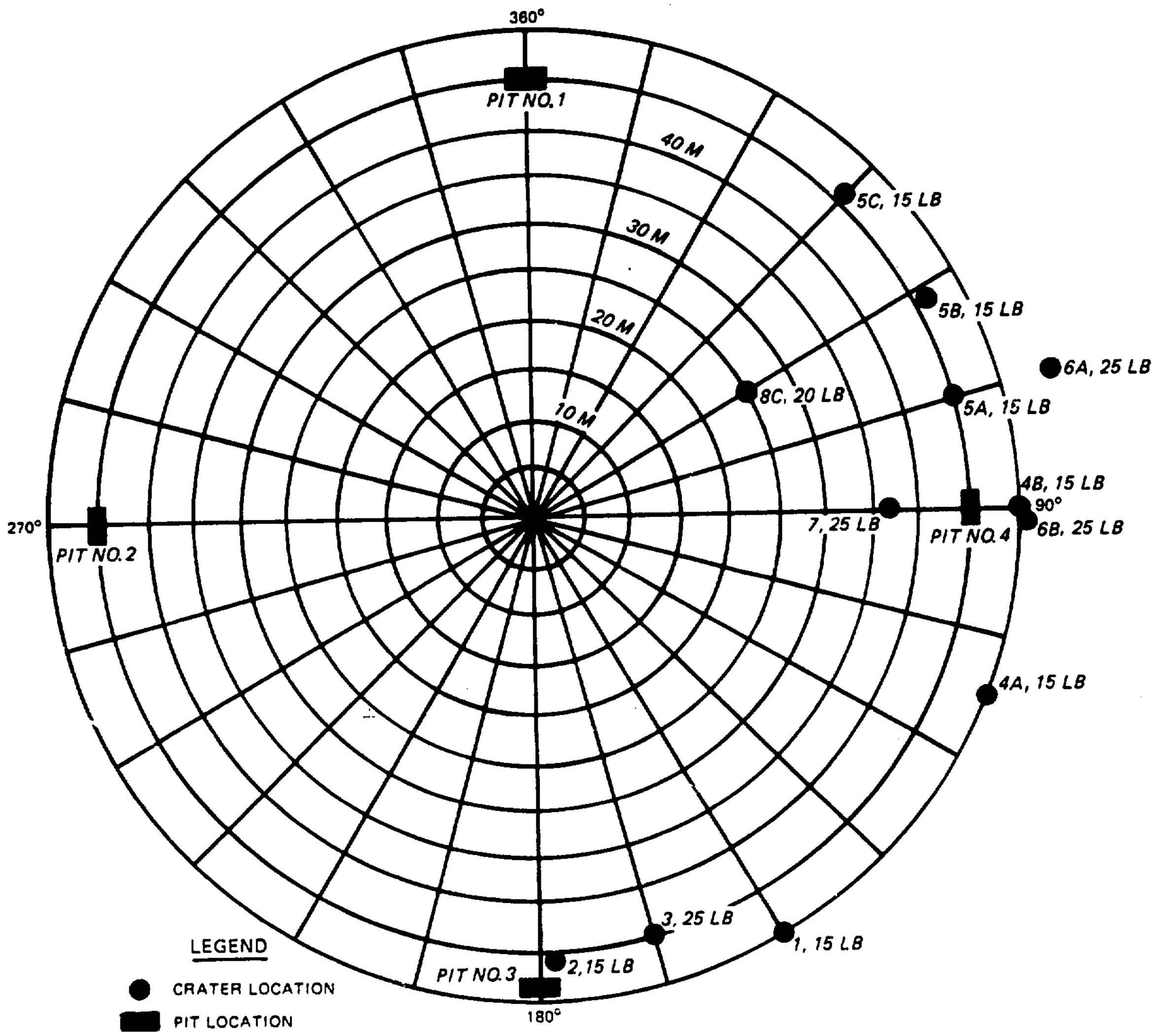
DEPTH/ELEV SIDE/SCOOP (20cm) DATE 19 AUG 83
4-26-83 Date sampled 12-28 Apr 83

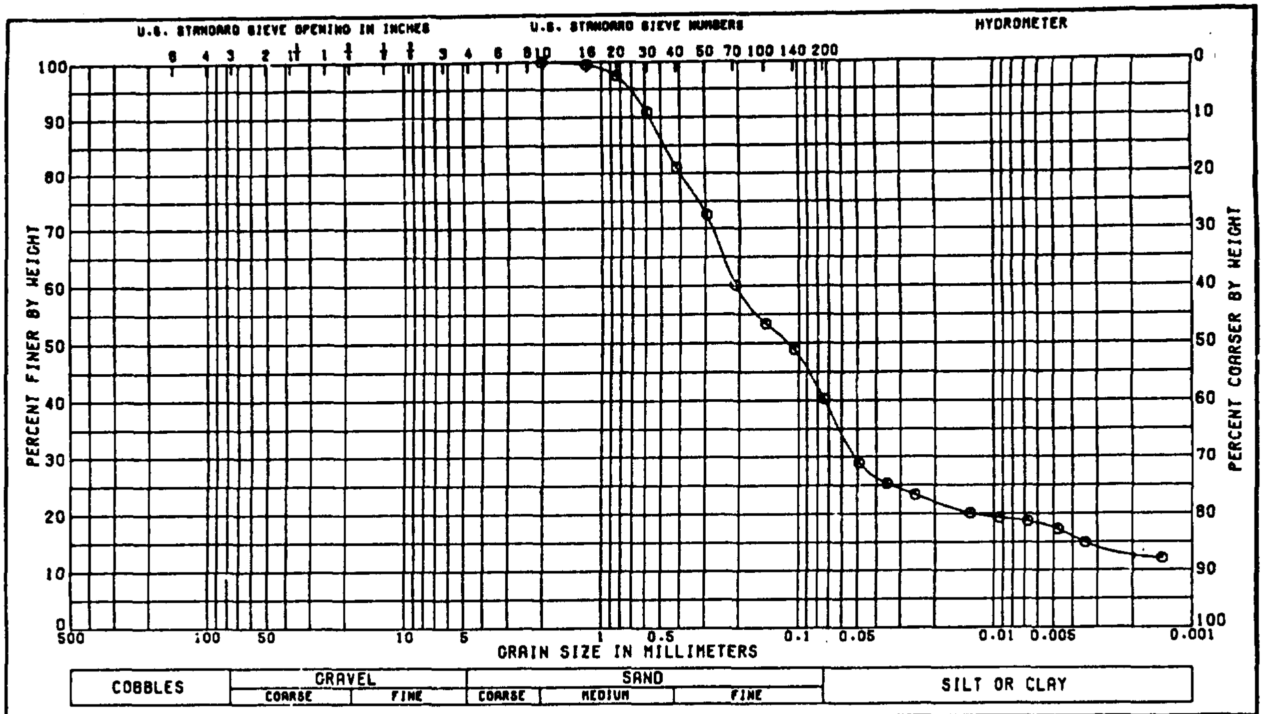
PIT SOIL DATA: DOT II

Pit Sample	Date 1983	Locale (m) X	Locale (m) Y	Depth cm	Soil Type USCS	% Finer 0.074um	Density* gm/cc	Organic Matter%	Moisture Content%	Specific Gravity
P1	7-29	0	45	50	SC	40	1.63/1.53	1.2	6.6	2.68
P1A	7-29	0	45	175	SC	44	1.70/1.56	1.4	9.0	2.70
P2	7-29	270	46	70	CL	52	1.73/1.60	1.1	8.4	2.71
P2A	7-29	270	46	170	CL	57	1.58/1.45	1.8	9.3	2.70
P3	7-29	180	45	60	CL	85	-	3.1	7.5	2.70
P3A	7-29	180	45	170	SC	20	-	0.8	3.2	2.67
P4	7-29	90	45	75	CL	65	1.65/1.55	2.1	6.5	2.70
P4A	7-29	90	45	175	CL	57	1.75/1.63	1.5	7.5	2.70

* Density wet/density dry.




360°
PIT NO. 1
40 M
30 M
20 M
10 M
5C, 15 LB
5B, 15 LB
6A, 25 LB
8C, 20 LB
5A, 15 LB
4B, 15 LB
90°
6B, 25 LB
7, 25 LB
PIT NO. 4
270°
PIT NO. 2
4A, 15 LB
3, 25 LB
1, 15 LB
2, 15 LB
PIT NO. 3
180°
LEGEND
CRATER LOCATION
PIT LOCATION



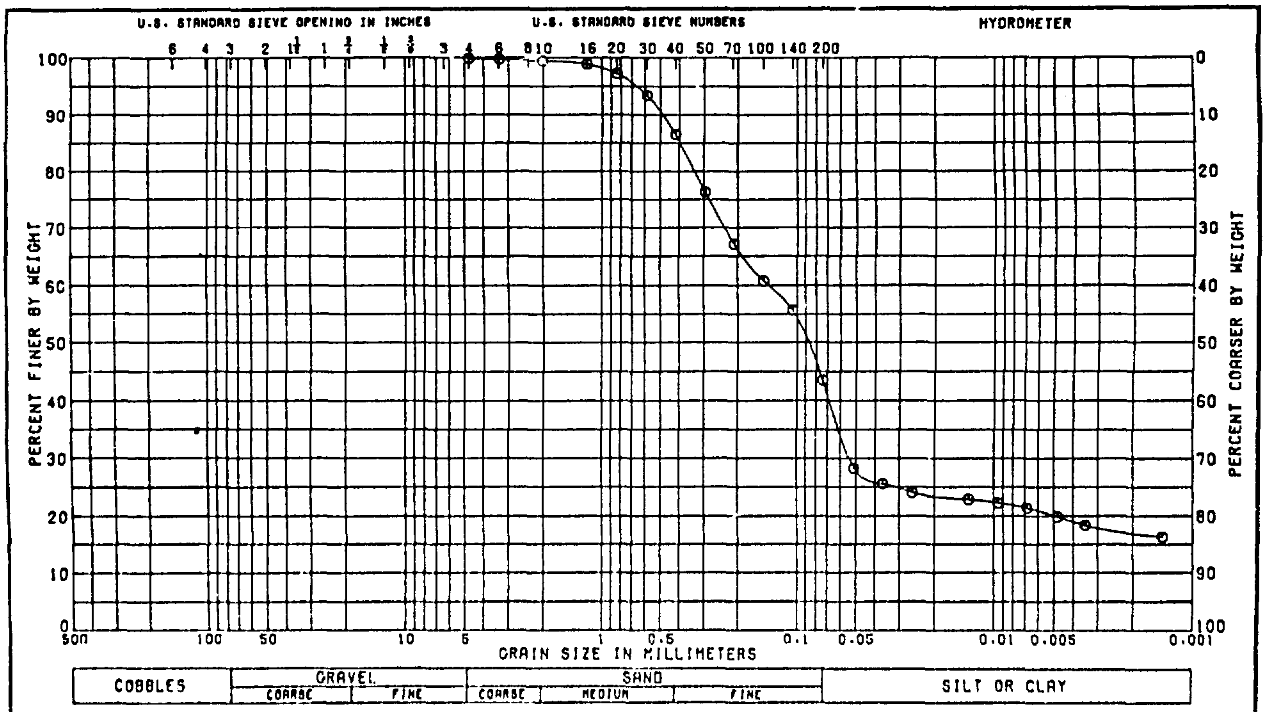
LL 25	PL 12	PI 13	GS 2.68	NAT W.%	ORG. CONT. 1.2%

CLASSIFICATION
CLAYEY SAND (SC), REDDISH BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON CO.
0, 45

BORING NO. 7-29-83 SAMPLE NO. P-1
DEPTH/ELEV 50CM DATE 25 OCT 83



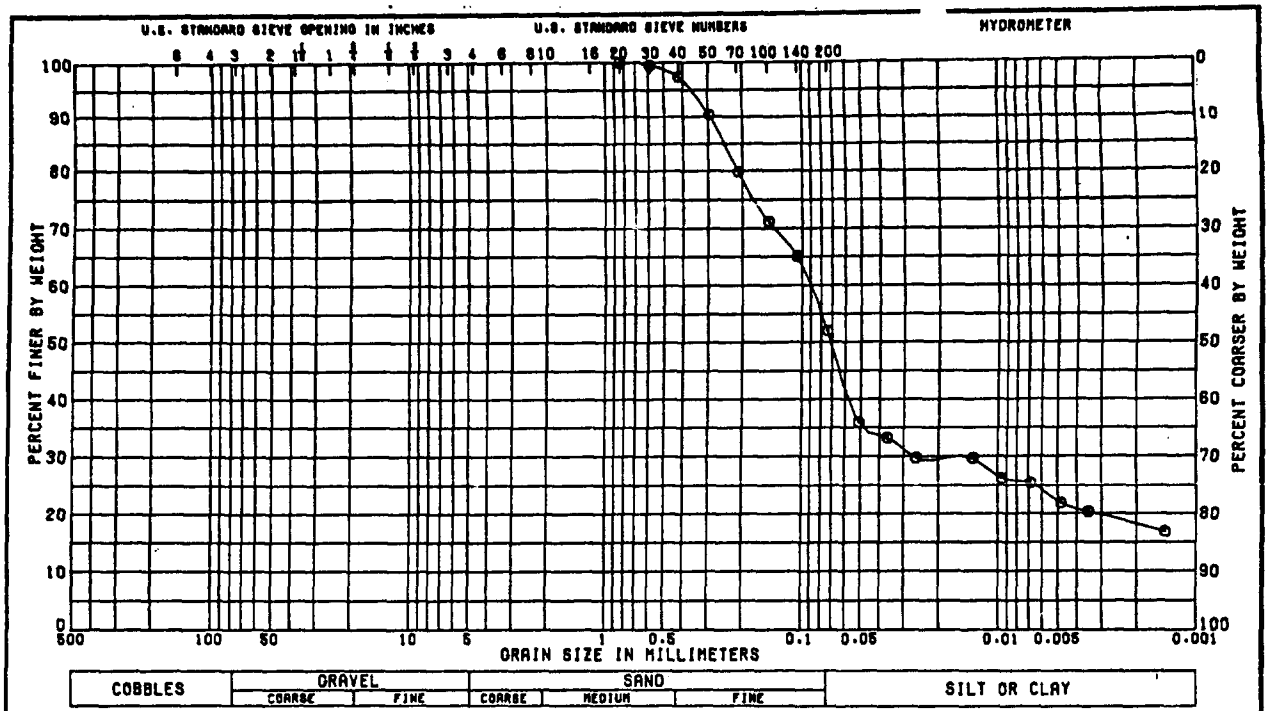
LL 29	PL 12	PI 17	GS 2.70	NAT W.%	ORG. CONT. 1.4%

CLASSIFICATION
CLAYEY SAND (SC), RED

GRADATION CURVE

PROJECT DOT II FT. CARSON CO.
0, 45

BORING NO. 7-29-83 SAMPLE NO. P-1A
DEPTH/ELEV 175CM DATE 25 OCT 83



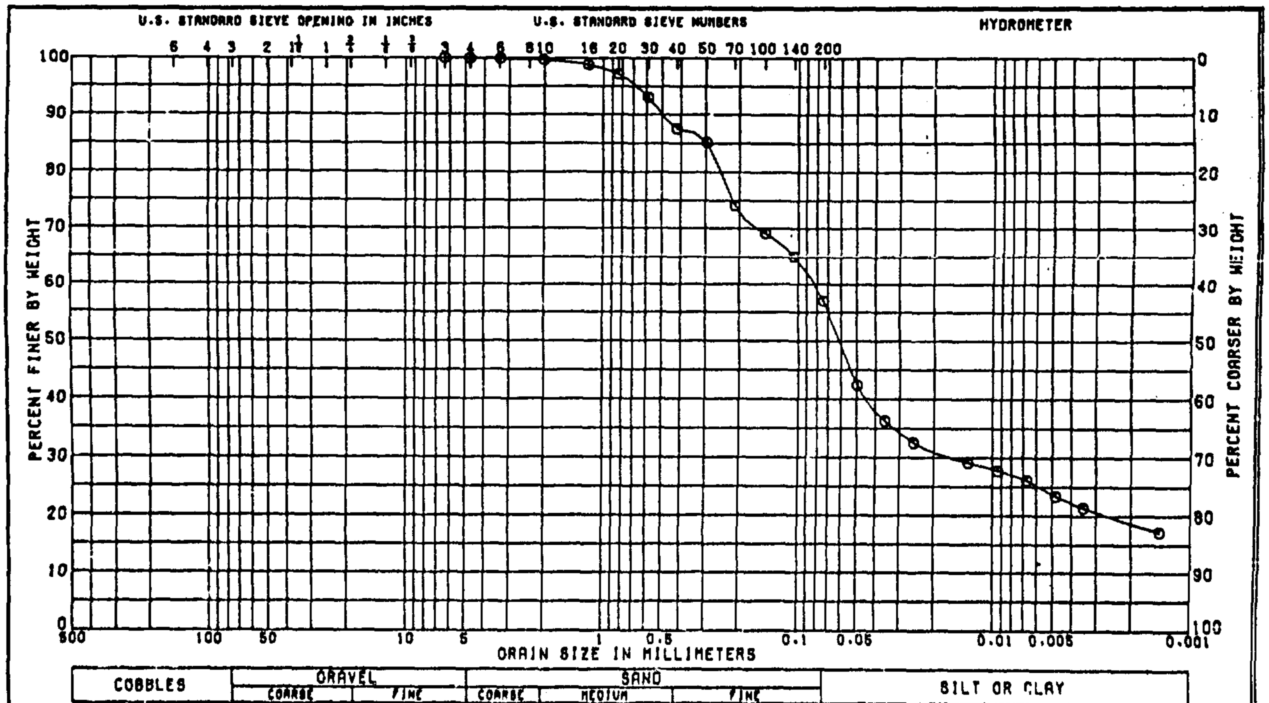
LL 29	PL 13	PI 16	GS 2.71	NAT W.%	ORG. CONT. 1.1%

CLASSIFICATION
SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON CO.
270, 46

BORING NO. 7-29-83 SAMPLE NO. P-2
DEPTH/ELEV 75CM DATE 25 OCT 83

GRADATION CURVE



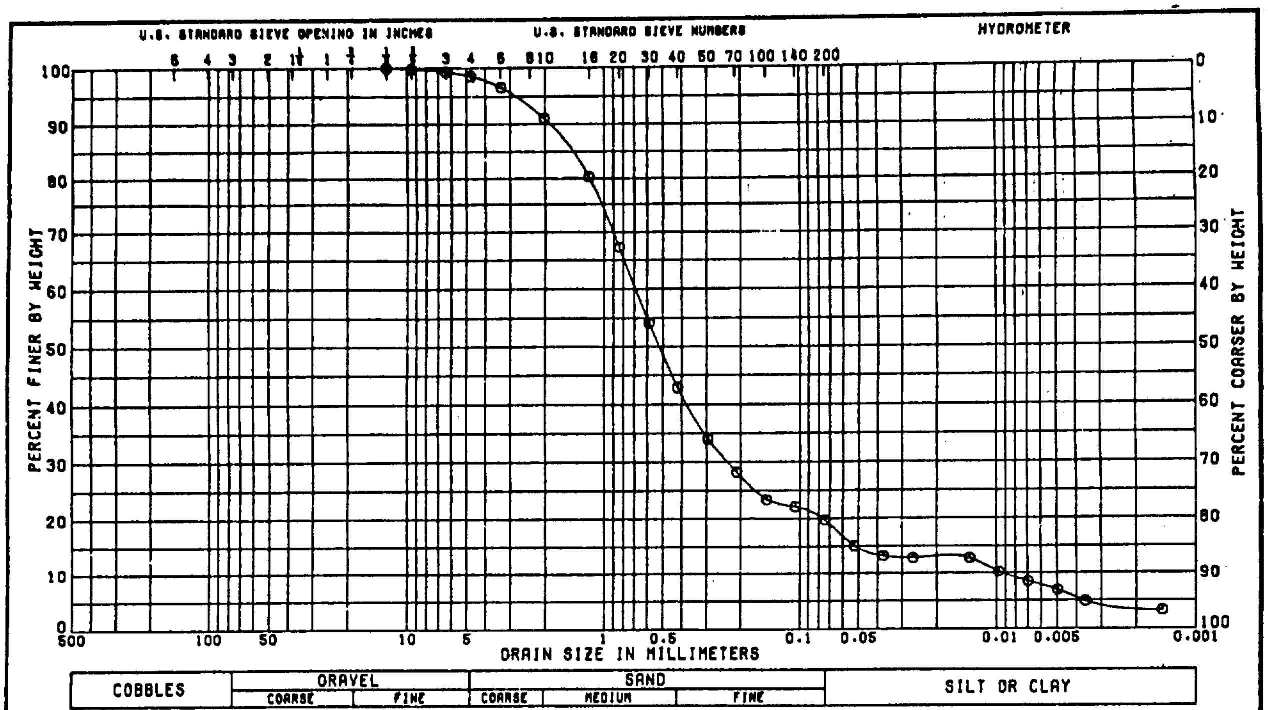
LL 31	PL 13	PI 18	GS 2.70	NAT W.%	ORG. CONT. 1.8%

CLASSIFICATION
SANDY CLAY (CL), REDDISH BROWN

PROJECT DOT II FT. CARSON CO.
270, 46

BORING NO. 7-29-83 SAMPLE NO. P-2A
DEPTH/ELEV 170CM DATE 25 OCT 83

GRADATION CURVE



LL 43	PL 16	PI 27	GS 2.67	NAT W.%	ORG. CONT. 0.8%

CLASSIFICATION

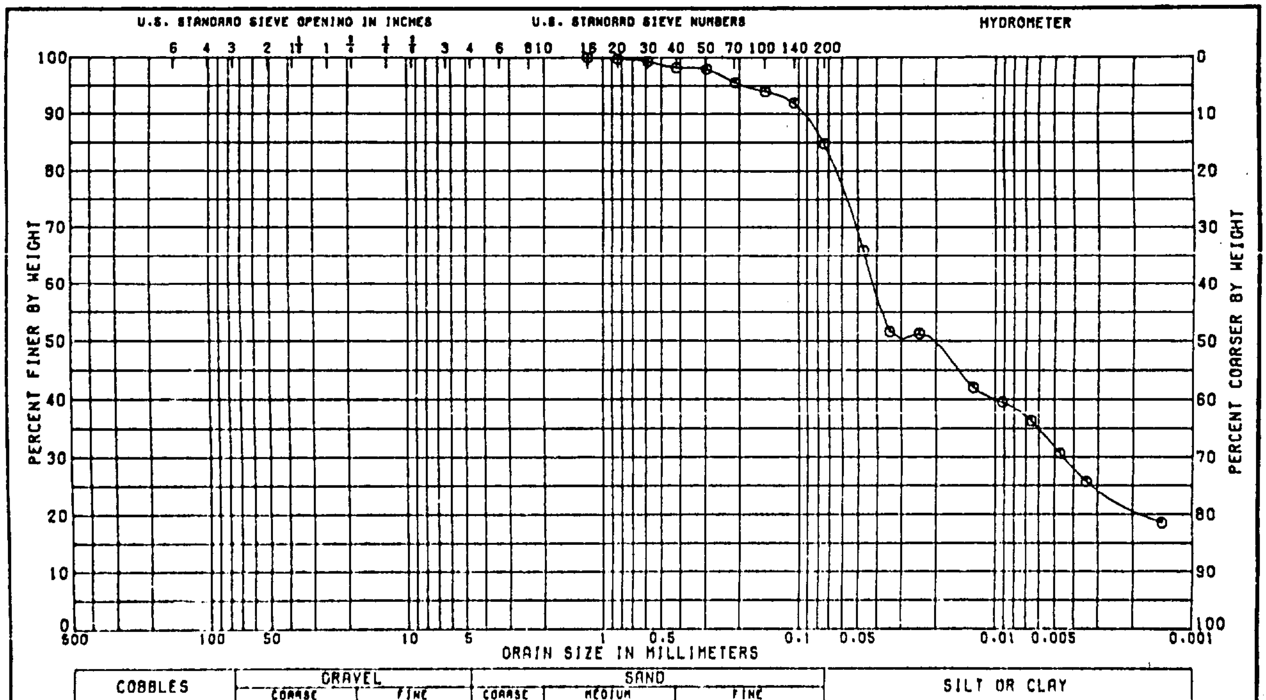
CLAYEY SAND (SC), RED

PROJECT DOT II FT. CARSON CO.
180, 45

BORING NO. 7-29-83 SAMPLE NO. P-3

DEPTH/ELEV 170CM DATE 25 OCT 83

GRADATION CURVE



LL 36	PL 17	PI 19	GS 2.70	NAT W.%	ORG. CONT. 1.1%

CLASSIFICATION

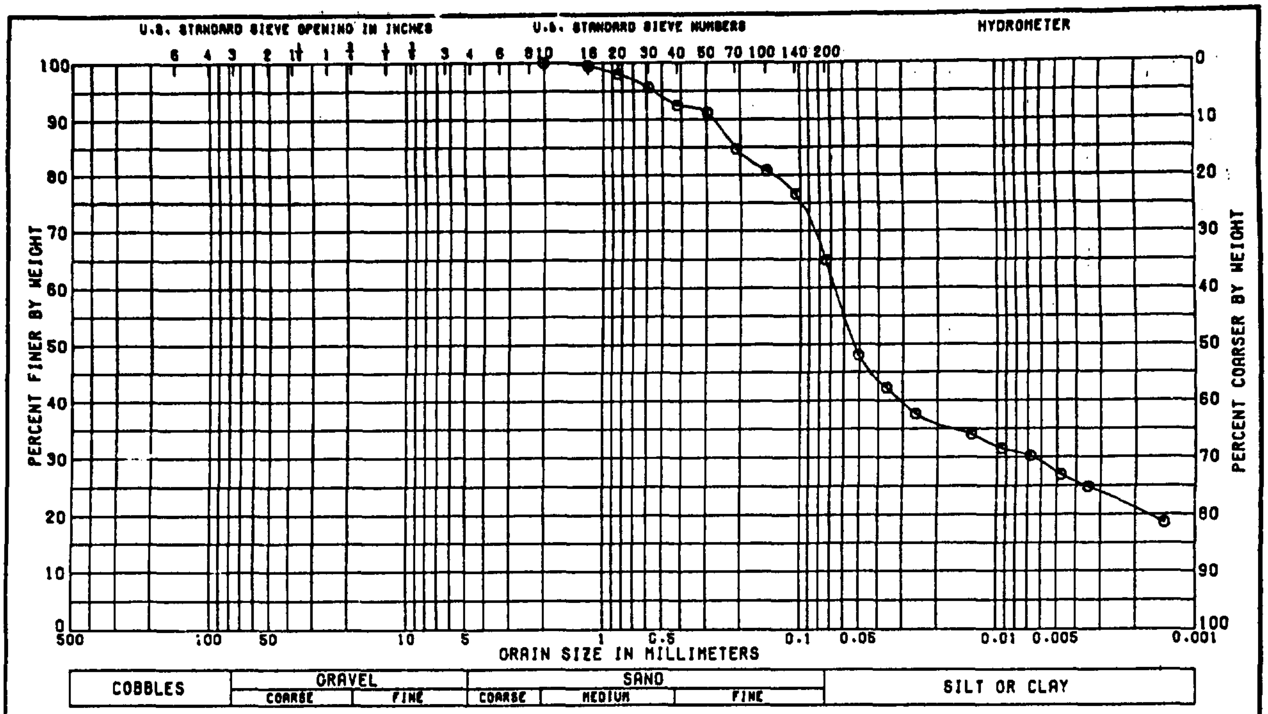
SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON CO.
180, 45

BORING NO. 7-29-83 SAMPLE NO. P-3A

DEPTH/ELEV 60CM DATE 25 OCT 83

GRADATION CURVE



LL 33 | PL 13 | PI 20 | GS 2.70 | NAT W.% | ORG. CONT. 2.1%

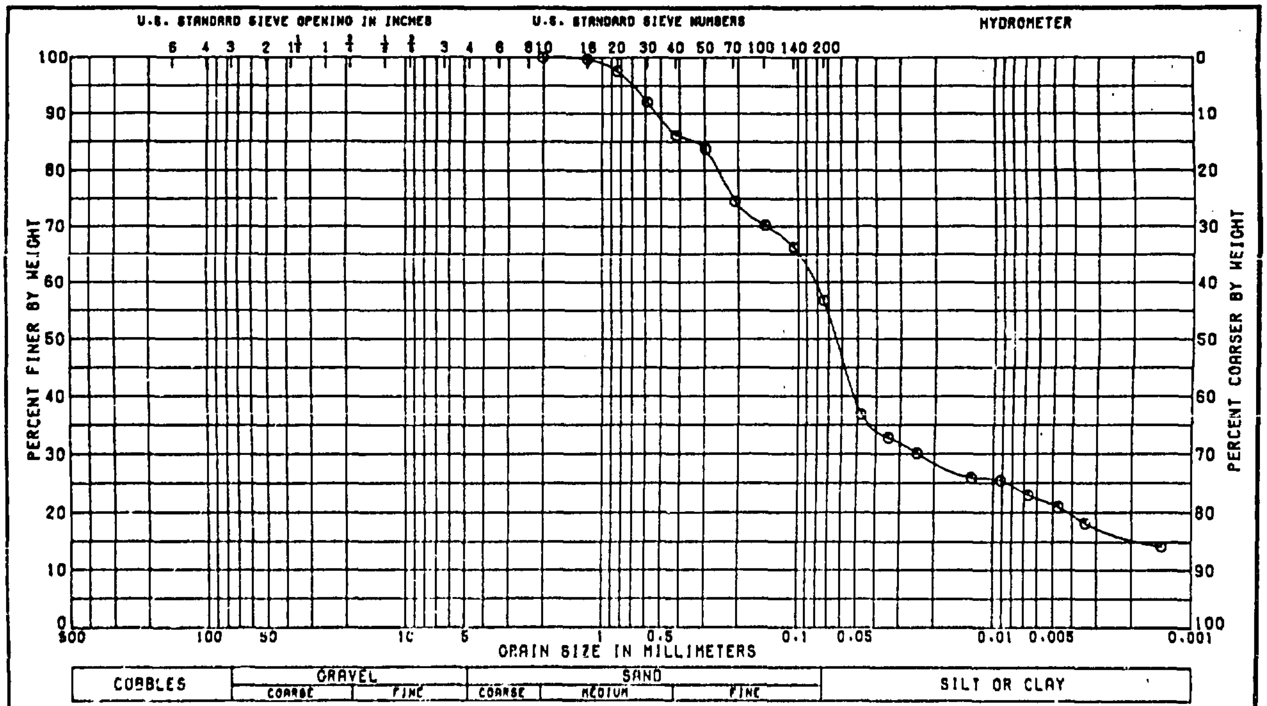
CLASSIFICATION
SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON CO.
90, 45

BORING NO. 7-29-83 SAMPLE NO. P-4

DEPTH/ELEV 75CM DATE 25 OCT 83

GRADATION CURVE



LL 24 | PL 12 | PI 12 | GS 2.70 | NAT W.% | ORG. CONT. 1.5%

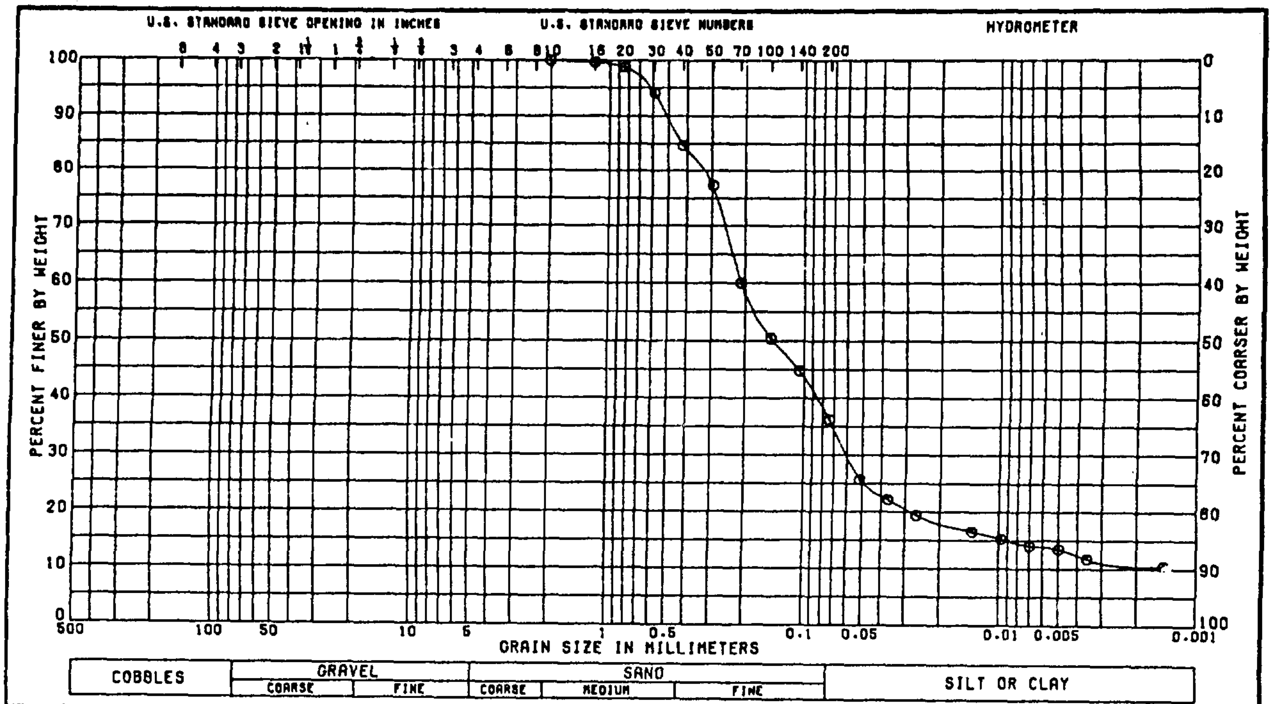
CLASSIFICATION
SANDY CLAY (CL), REDDISH BROWN

PROJECT DOT II FT. CARSON CO.
90, 45

BORING NO. 7-29-83 SAMPLE NO. P-4A

DEPTH/ELEV 175CM DATE 25 OCT 85

GRADATION CURVE



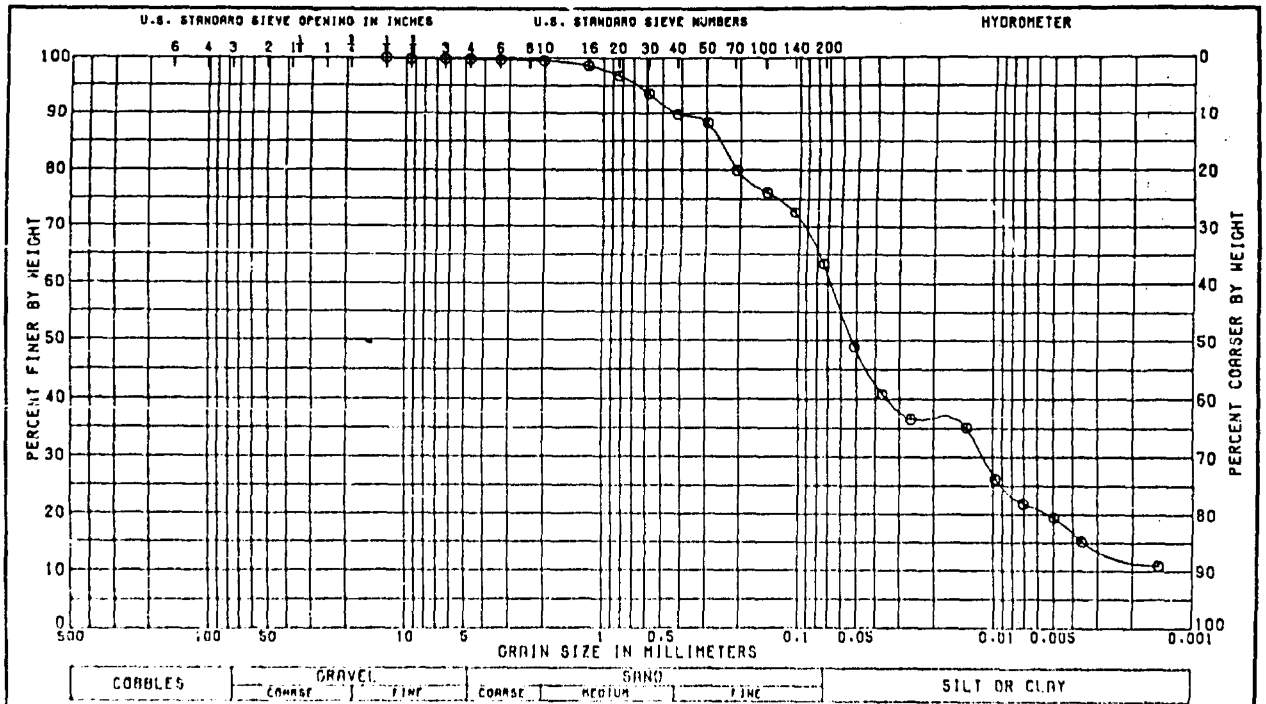
LL	PL	PI	GS	NAT W.%	ORG. CONT.
21	14	7	2.66		1.9%

CLASSIFICATION

CLAYEY SAND (SC), REDDISH BROWN

PROJECT DOT II FT. CARSON CO.
0, 50
BORING NO. 7-27-83 SAMPLE NO. 5
DEPTH/ELEV 0-15CM DATE 25 OCT 83

GRADATION CURVE



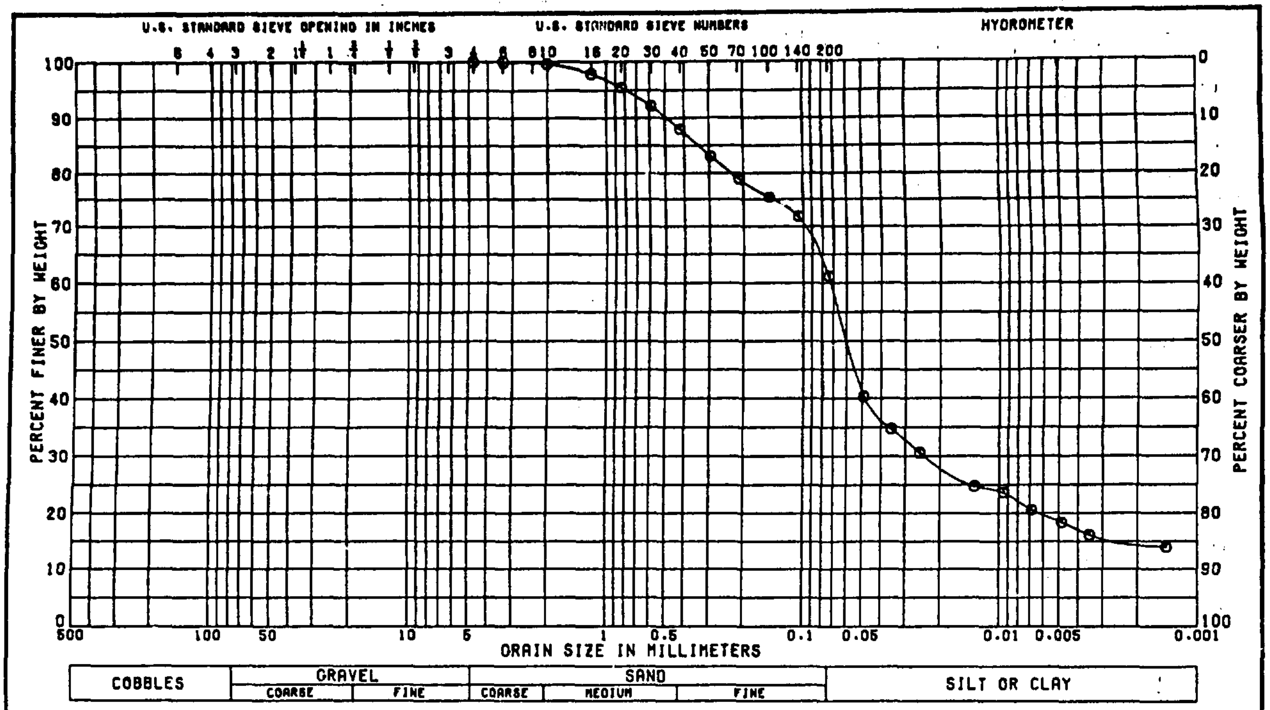
LL	PL	PI	GS	NAT W.%	ORG. CONT.
25	16	9	2.66		2.8%

CLASSIFICATION

SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON CO.
90, 50
BORING NO. 7-27-83 SAMPLE NO. 6
DEPTH/ELEV 0-15CM DATE 25 OCT 83

GRADATION CURVE



LL 27	PL 14	PI 13	GS 2.68	NAT W.%	ORG. CONT. 2.7%

CLASSIFICATION

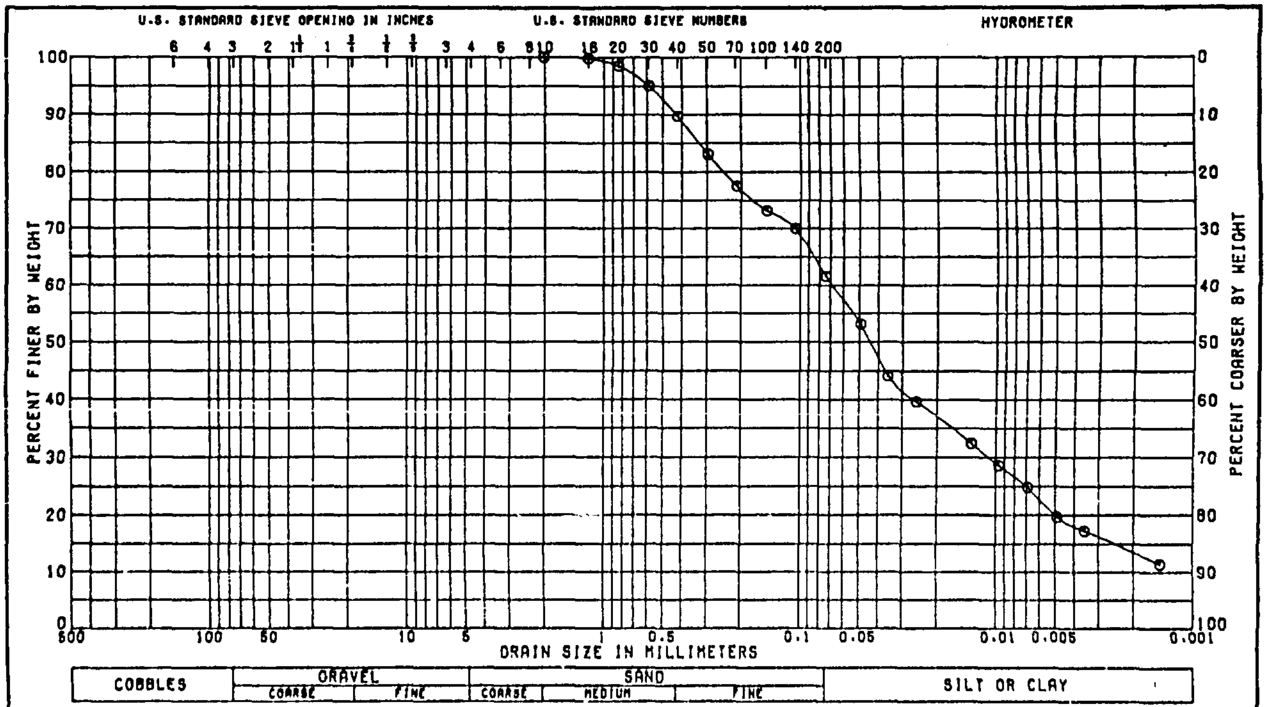
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON CO.
180, 50

BORING NO. 9-27-83 SAMPLE NO. 7

DEPTH/ELEV 0-15CM DATE 25 OCT 83



LL 27	PL 16	PI 11	GS 2.65	NAT W.%	ORG. CONT. 2.4%

CLASSIFICATION

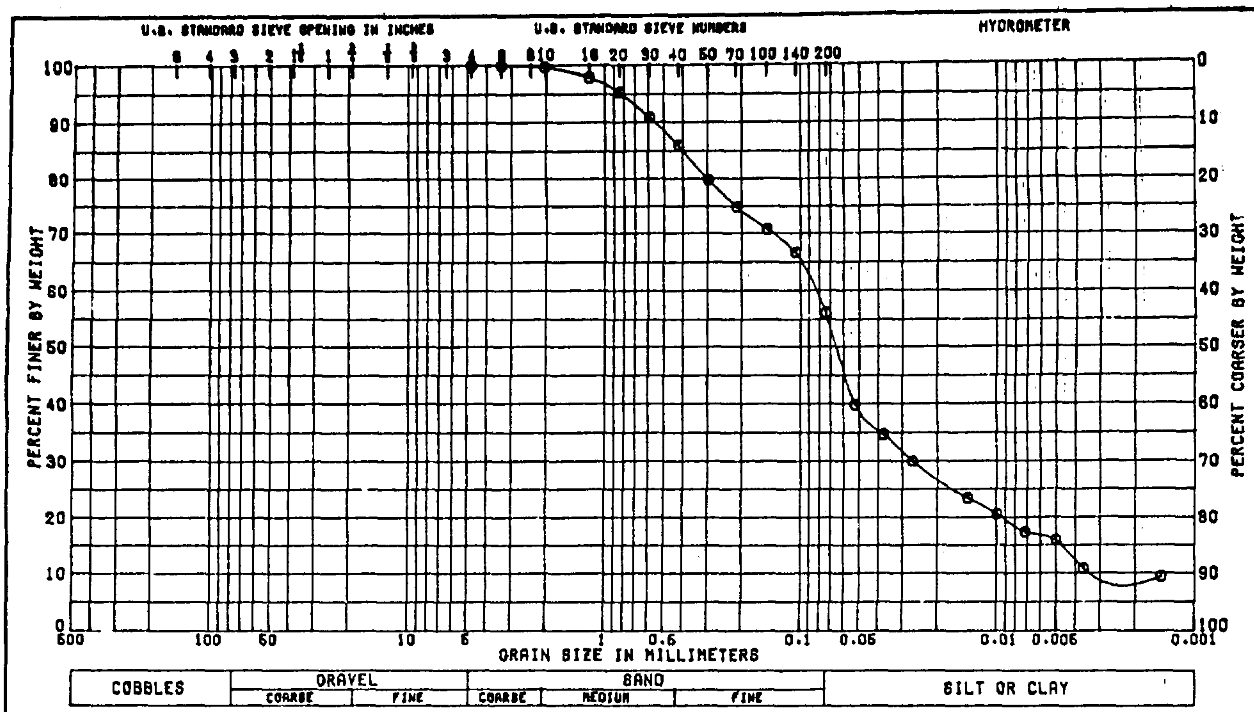
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON CO.
270,50

BORING NO. 7-27-83 SAMPLE NO. 8

DEPTH/ELEV 0-15CM DATE 25 OCT 83



LL 23	PL 18	PI 5	GS 2.68	NAT W.%	ORG. CONT. 2.8%

CLASSIFICATION

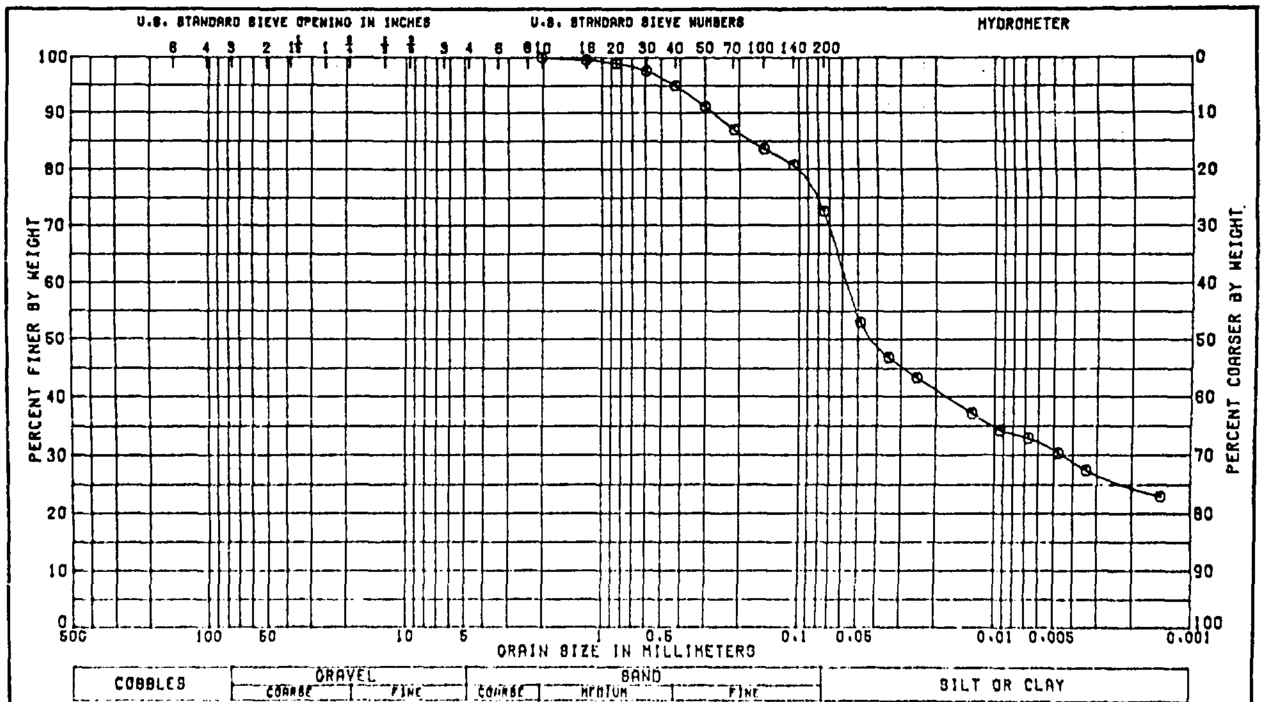
SANDY SILTY CLAY (CL-ML), BROWN

PROJECT DOT II FT. CARSON, CO
150, 50

BORING NO. 8-4-83 SAMPLE NO. POS-1

DEPTH/ELEV 53CM DATE 07 NOV 83

GRADATION CURVE



LL 31	PL 13	PI 18	GS 2.68	NAT W.%	ORG. CONT. 3.6%

CLASSIFICATION

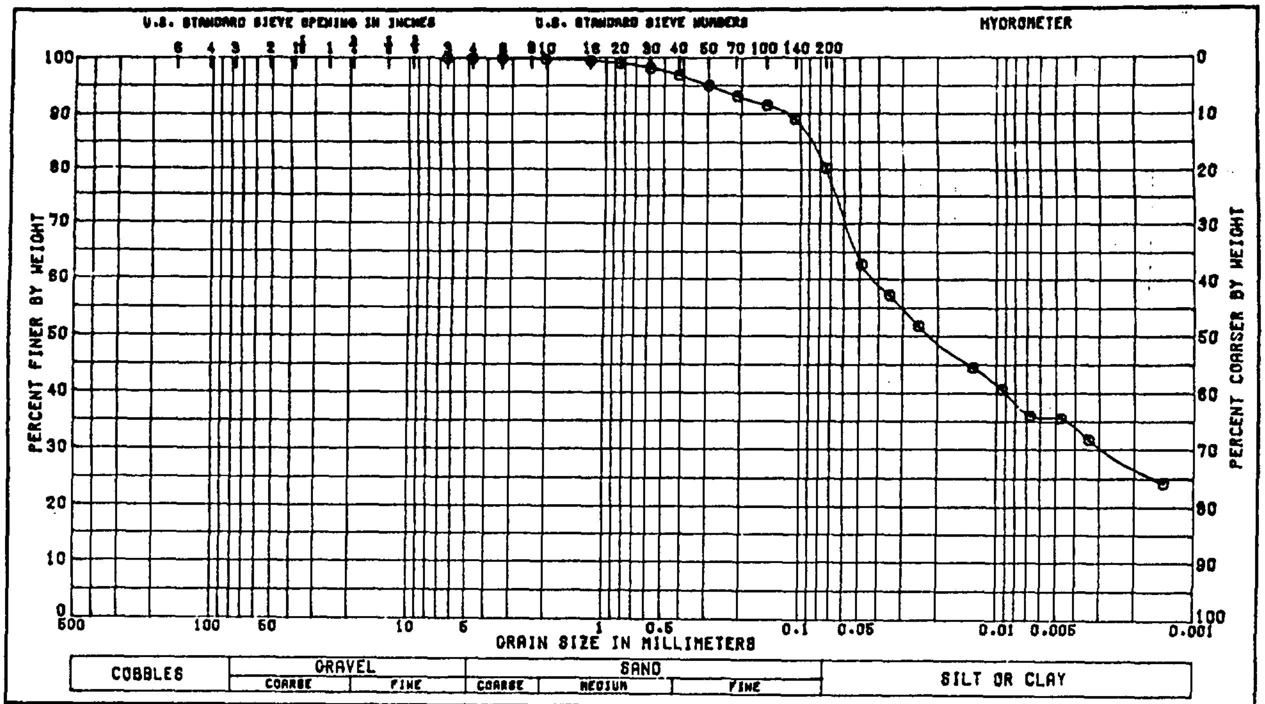
SANDY CLAY (CL), REDDISH BROWN

PROJECT DOT II FT. CARSON, CO
179, 46

BORING NO. 8-4-83 SAMPLE NO. PRE-2

DEPTH/ELEV 0-15CM DATE 07 NOV 83

GRADATION CURVE



LL 41	PL 14	PI 27	GS 2.70	NAT W.%	ORG. CONT. 2.4%

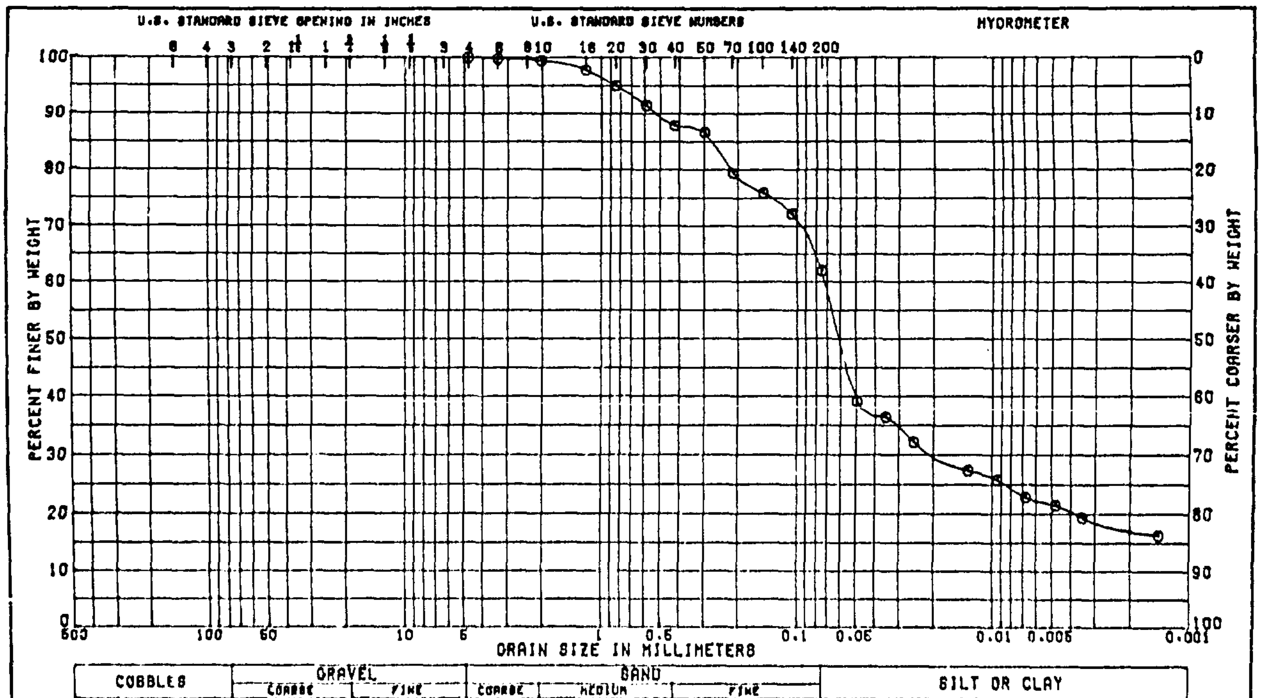
CLASSIFICATION

SANDY CLAY (CL), REDDISH BROWN

PROJECT DOT II FT. CARSON, CO
112, 50

BORING NO. 8-4-83 SAMPLE NO. PRE-4A
DEPTH/ELEV 0-15CM DATE 07 NOV 83

GRADATION CURVE



LL 27	PL 12	PI 15	GS 2.07	NAT W.%	ORG. CONT. 2.8%

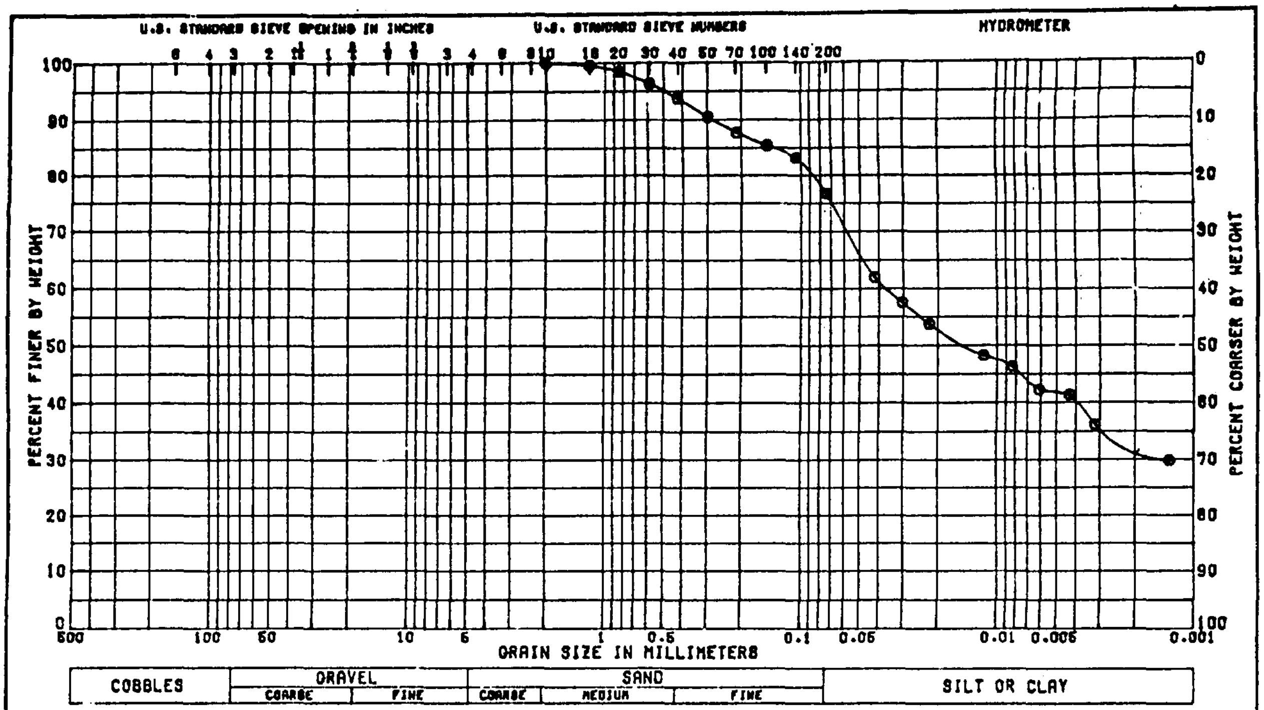
CLASSIFICATION

SANDY CLAY (CL), REDDISH BROWN

PROJECT DOT II FT. CARSON, CO
112, 50

BORING NO. 8-4-83 SAMPLE NO. POS-4A
DEPTH/ELEV 0-15CM DATE 07 NOV 83

GRADATION CURVE



LL 52	PL 15	PI 37	GS 2.70	NAT W.%	ORG. CONT. 3.4%

CLASSIFICATION

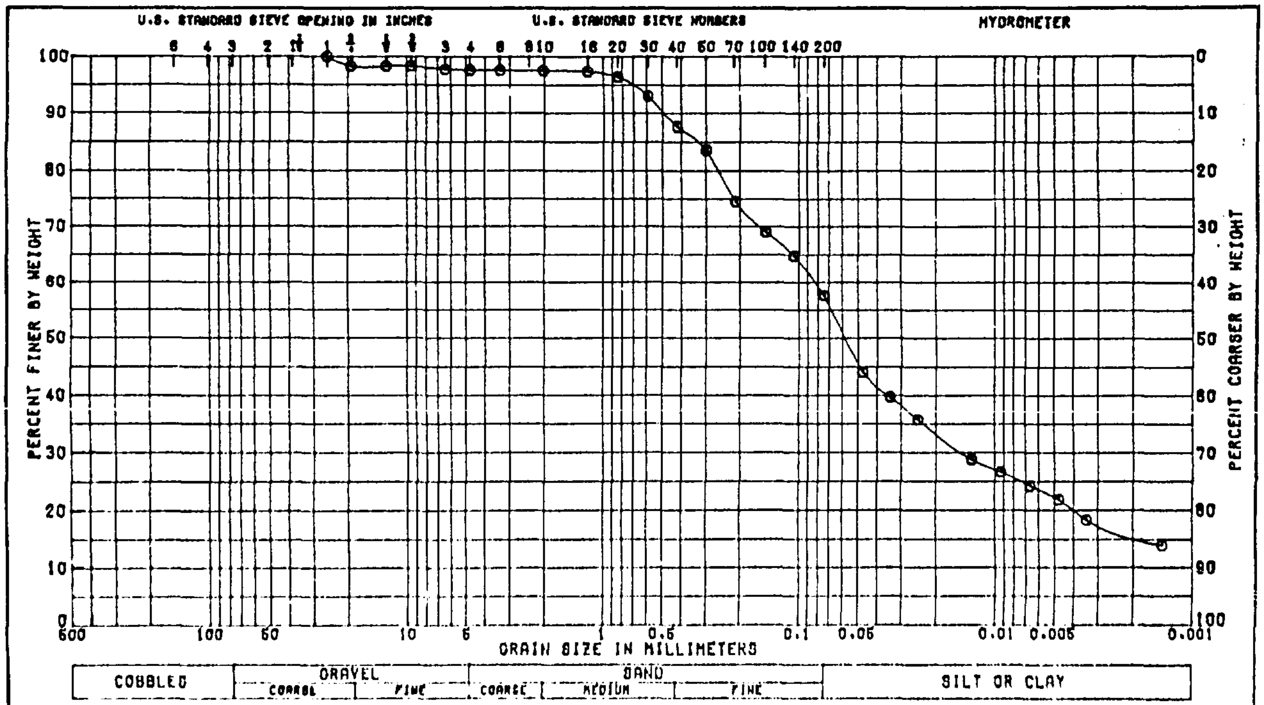
SANDY CLAY (CH), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
61, 47

BORING NO. 8-5-83 SAMPLE NO. 5B

DEPTH/ELEV 38CM DATE 07 NOV 83



LL 22	PL 12	PI 10	GS 2.65	NAT W.%	ORG. CONT. 1.8%

CLASSIFICATION

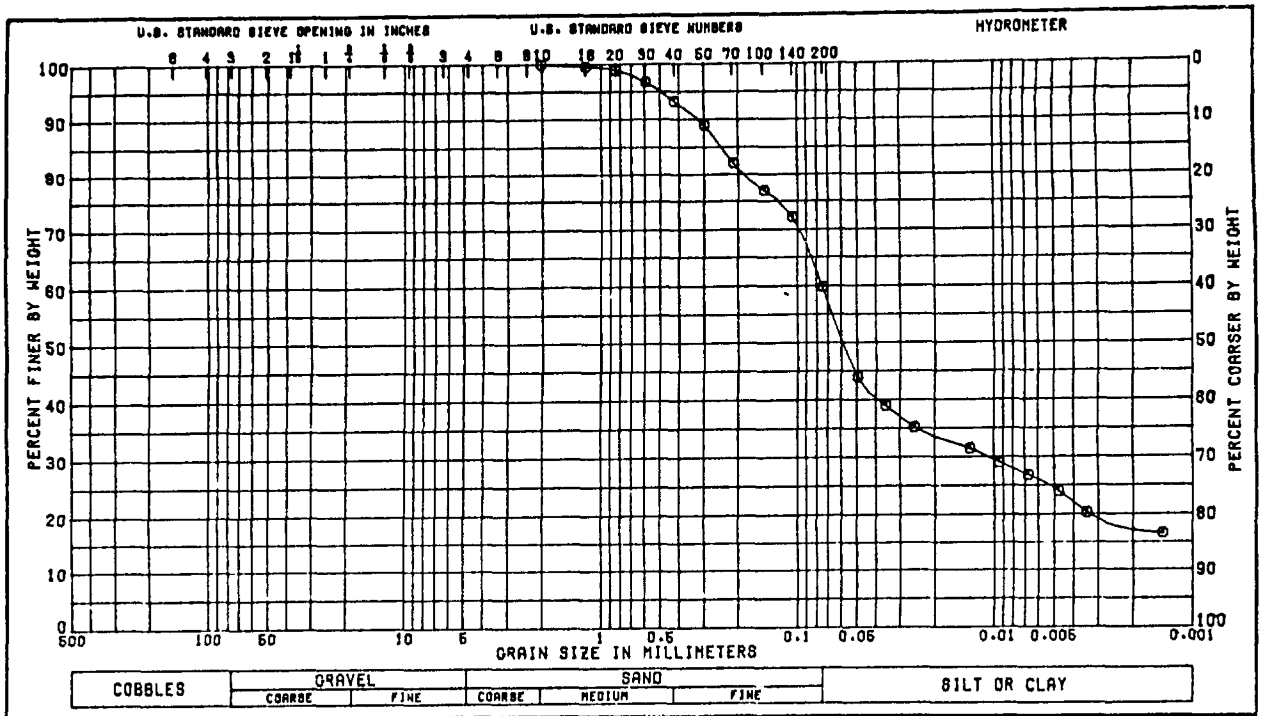
SANDY CLAY (CL), BROWN
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
45, 47

BORING NO. 8-5-83 SAMPLE NO. 5C

DEPTH/ELEV 48CM DATE 07 NOV 83



LL 27	PL 13	PI 14	GS 2.71	NAT W.%	ORG. CONT. 1.6%

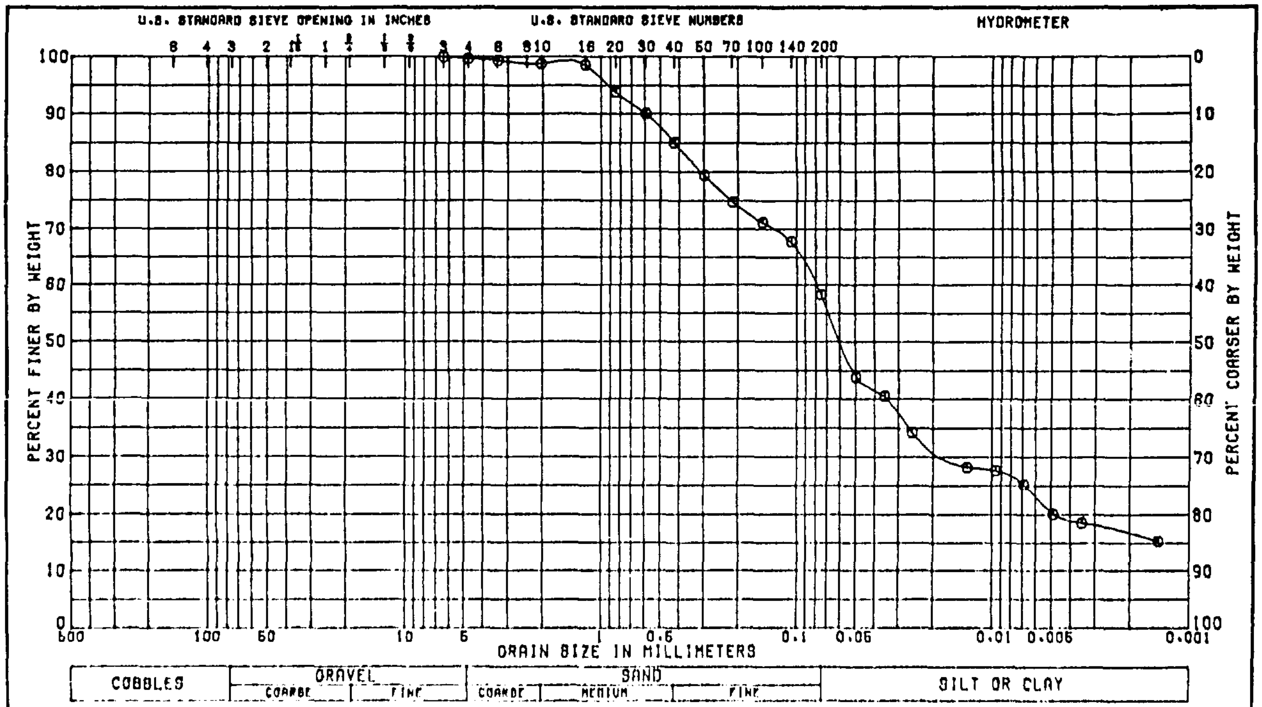
CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
90, 37

BORING NO. 8-5-83 SAMPLE NO. PRE-7

DEPTH/ELEV 0-15CM DATE 07 NOV 83



LL 25	PL 15	PI 10	GS 2.65	NAT W.%	ORG. CONT. 1.4%

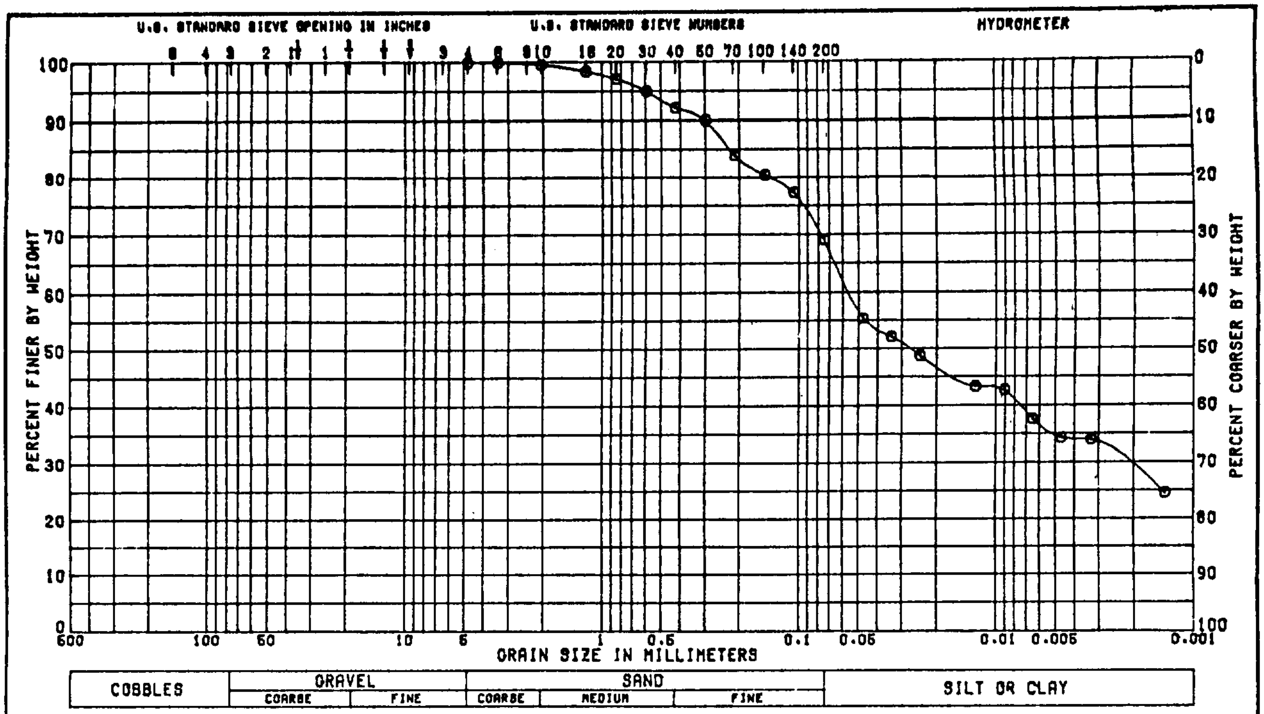
CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
75, 55

BORING NO. 8-5-83 SAMPLE NO. 8A

DEPTH/ELEV 57CM DATE 07 NOV 83



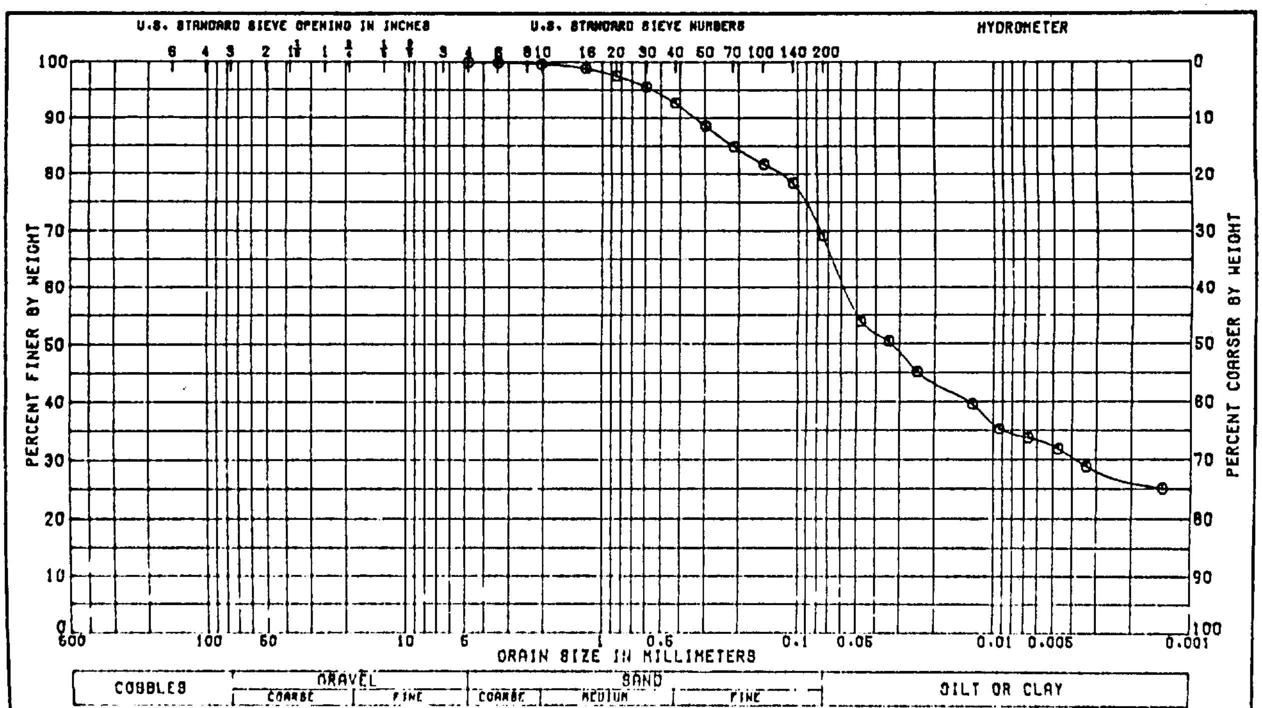
LL 45	PL 16	PI 29	GS 2.70	NAT W.%	ORG. CONT. 2.6%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
60, 25

BORING NO. 8-5-83 SAMPLE NO. 8C
DEPTH/ELEV 30CM DATE 07 NOV 83



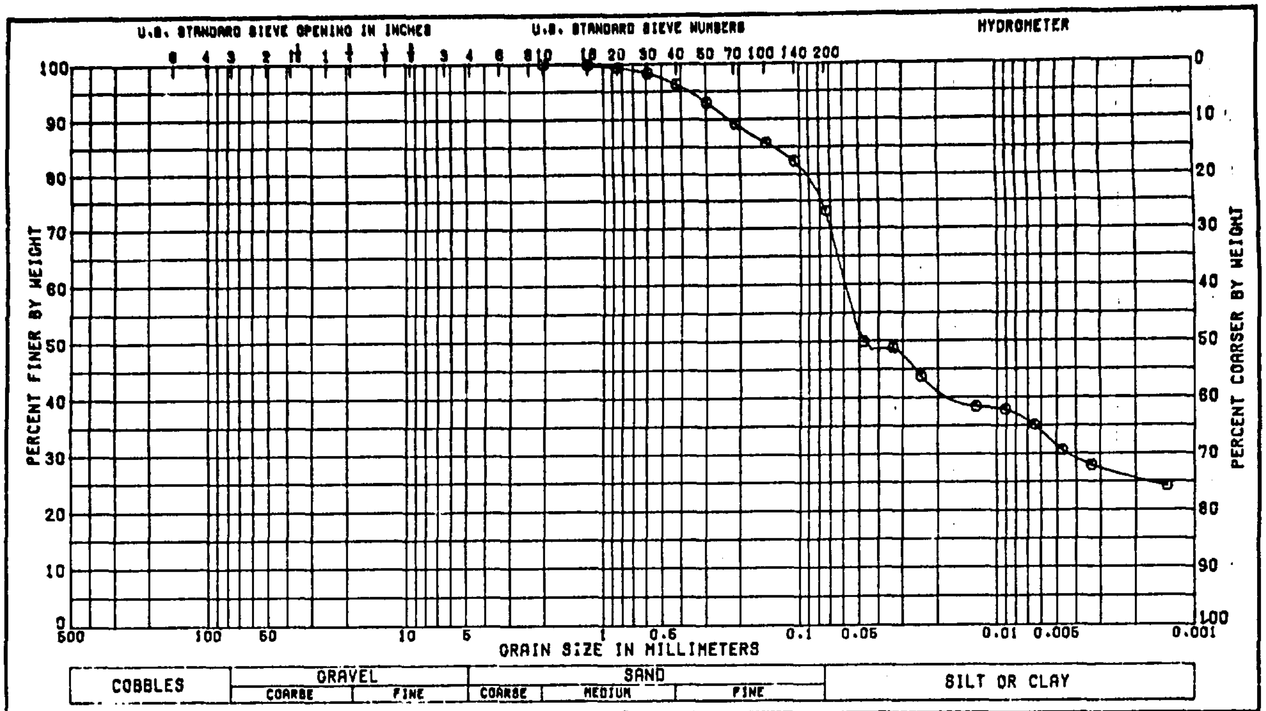
LL 37	PL 14	PI 23	GS 2.09	NAT W.%	ORG. CONT. 2.6%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
150, 50

BORING NO. 8-4-83 SAMPLE NO. S-1
DEPTH/ELEV 46CM DATE 07 NOV 83



LL 35	PL 14	PI 21	GS 2.68	NAT W.%	ORG. CONT. 2.9%

CLASSIFICATION

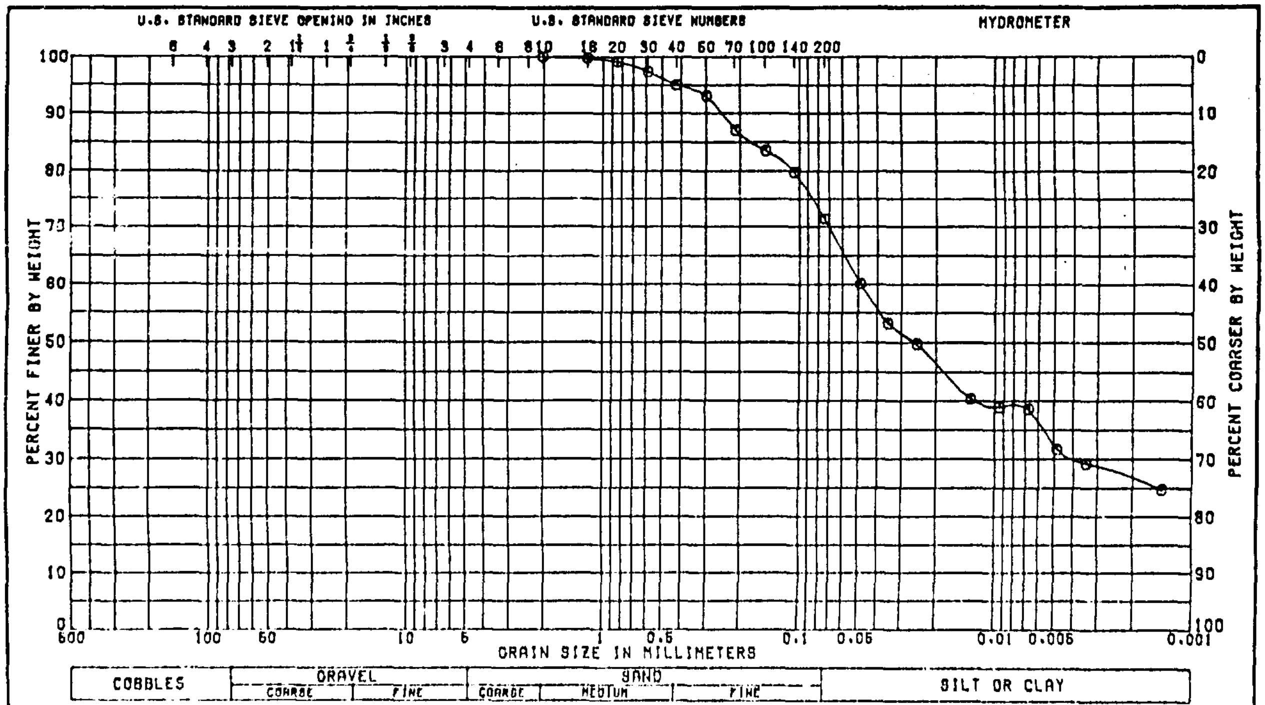
SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON, CO
179, 45

BORING NO. 8-4-83 SAMPLE NO. S-2

DEPTH/ELEV 36CM DATE 07 NOV 83

GRADATION CURVE



LL 41	PL 14	PI 27	GS 2.65	NAT W.%	ORG. CONT. 1.4%

CLASSIFICATION

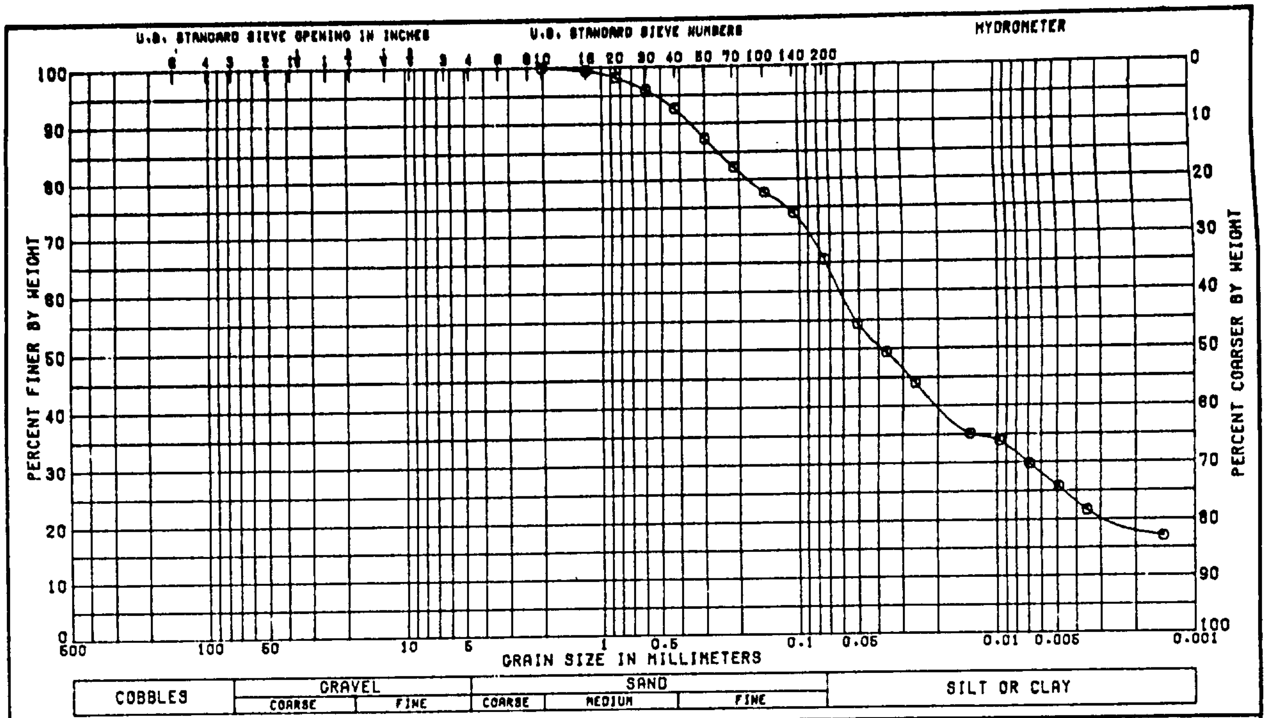
SANDY CLAY (CL), BROWN

PROJECT DOT II FT. CARSON, CO
165, 46

BORING NO. 8-4-83 SAMPLE NO. S-3

DEPTH/ELEV 43CM DATE 07 NOV 83

GRADATION CURVE



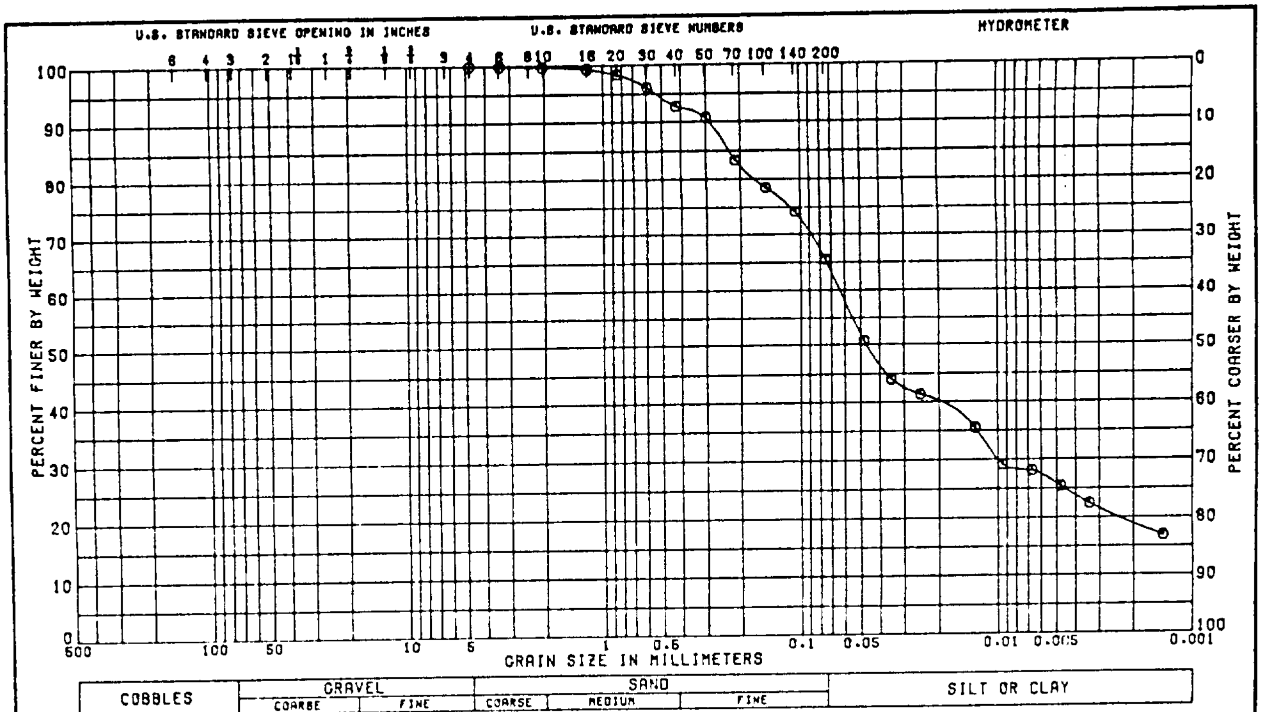
LL 29	PL 15	PI 14	GS 2.66	NAT W.%	ORG. CONT. 3.0%
CLASSIFICATION SANDY CLAY (CL), BROWN					

PROJECT DOT II FT. CARSON, CO
97, 50

BORING NO. B-4-83 SAMPLE NO. S-4B

DEPTH/ELEV 25CM DATE 07 NOV 83

GRADATION CURVE



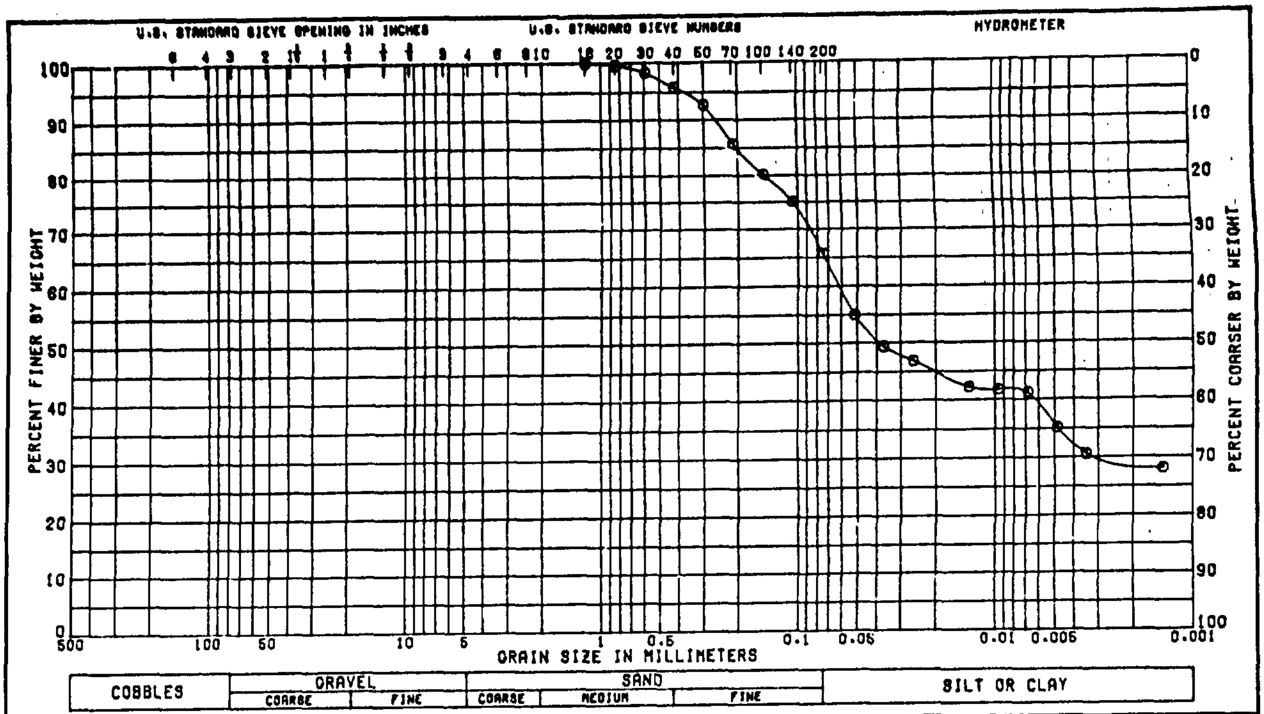
LL 33	PL 15	PI 18	GS 2.66	NAT W.%	ORG. CONT. 3.2%
CLASSIFICATION SANDY CLAY (CL), BROWN					

PROJECT DOT II FT. CARSON, CO
75, 47

BORING NO. B-4-83 SAMPLE NO. S-5A

DEPTH/ELEV 43CM DATE 07 NOV 83

GRADATION CURVE

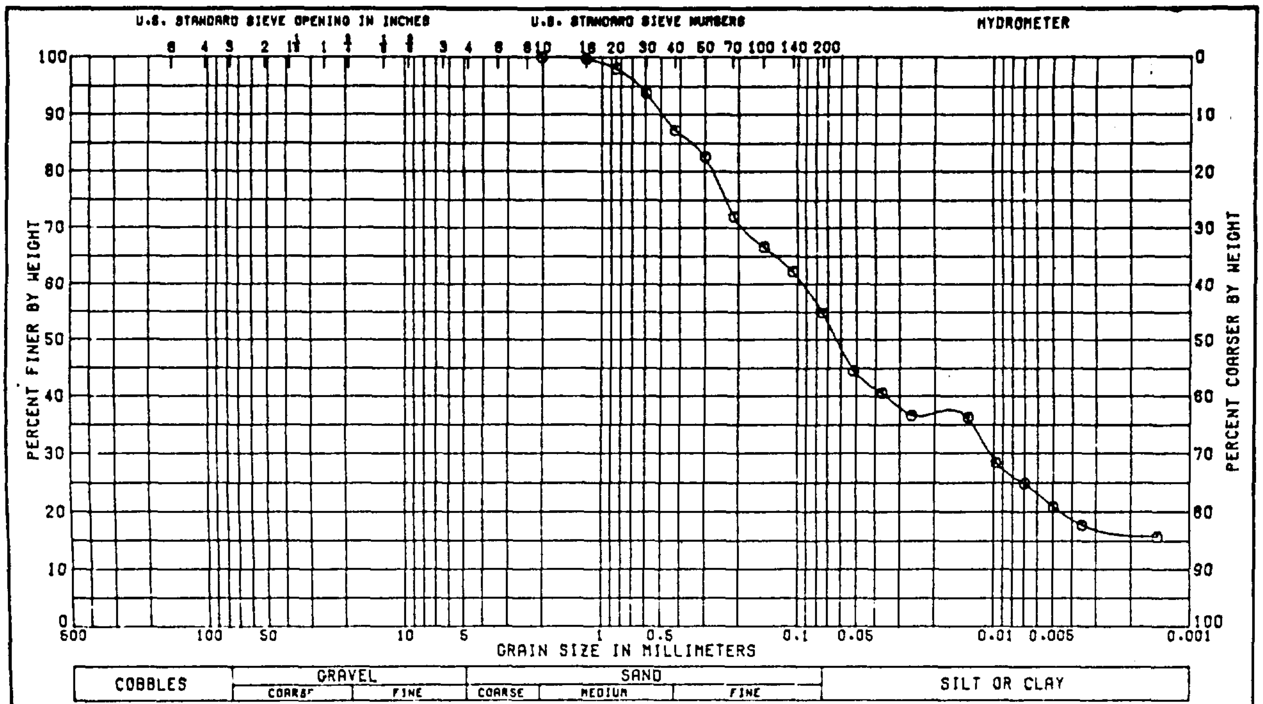


LL 46	PL 16	PI 30	GS 2.70	NAT W.%	ORG. CONT. 2.8%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
90, 37
BORING NO. 8-4-83 SAMPLE NO. S-7
DEPTH/ELEV 46CM DATE 07 NOV 83

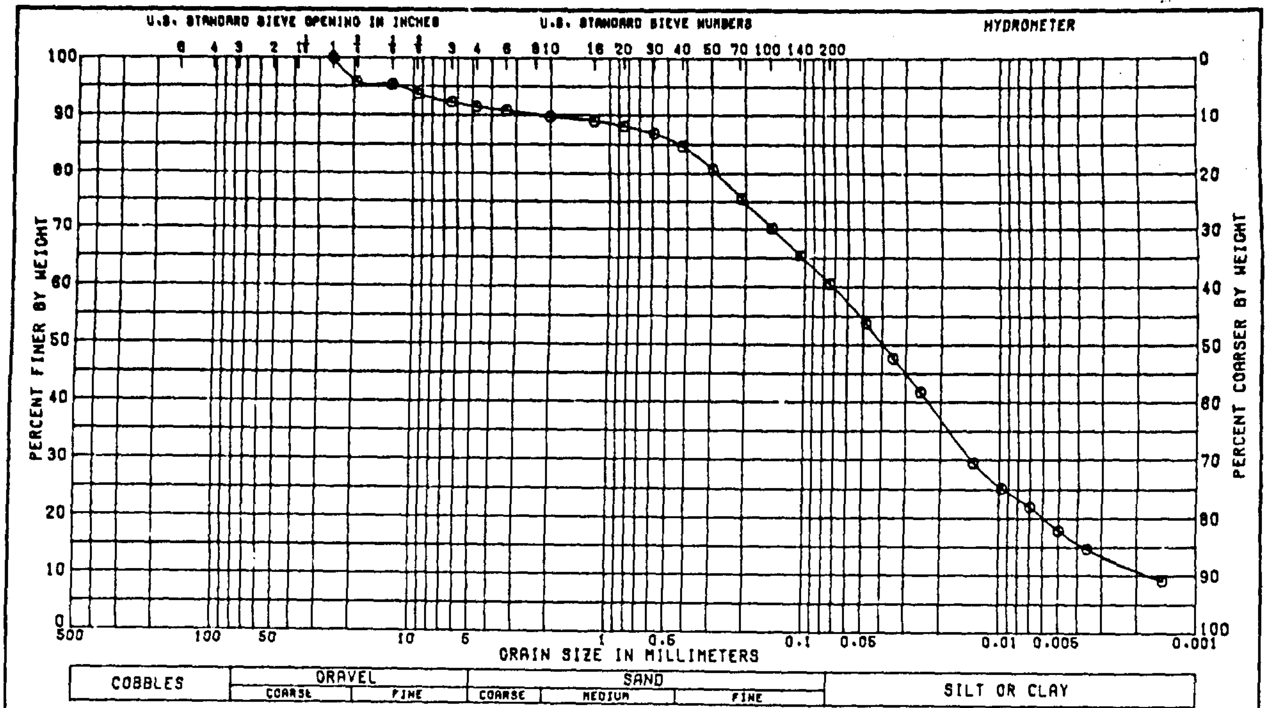


LL 23	PL 14	PI 9	GS 2.68	NAT W.%	ORG. CONT. 1.9%

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
60, 25
BORING NO. 8-4-83 SAMPLE NO. S-8C
DEPTH/ELEV 47CM DATE 07 NOV 83



LL 36	PL 26	PI 10	GS 2.84	NAT W.%	ORG. CONT. 4.6%

CLASSIFICATION

SANDY SILT (ML), GRAY: WITH GRAVEL

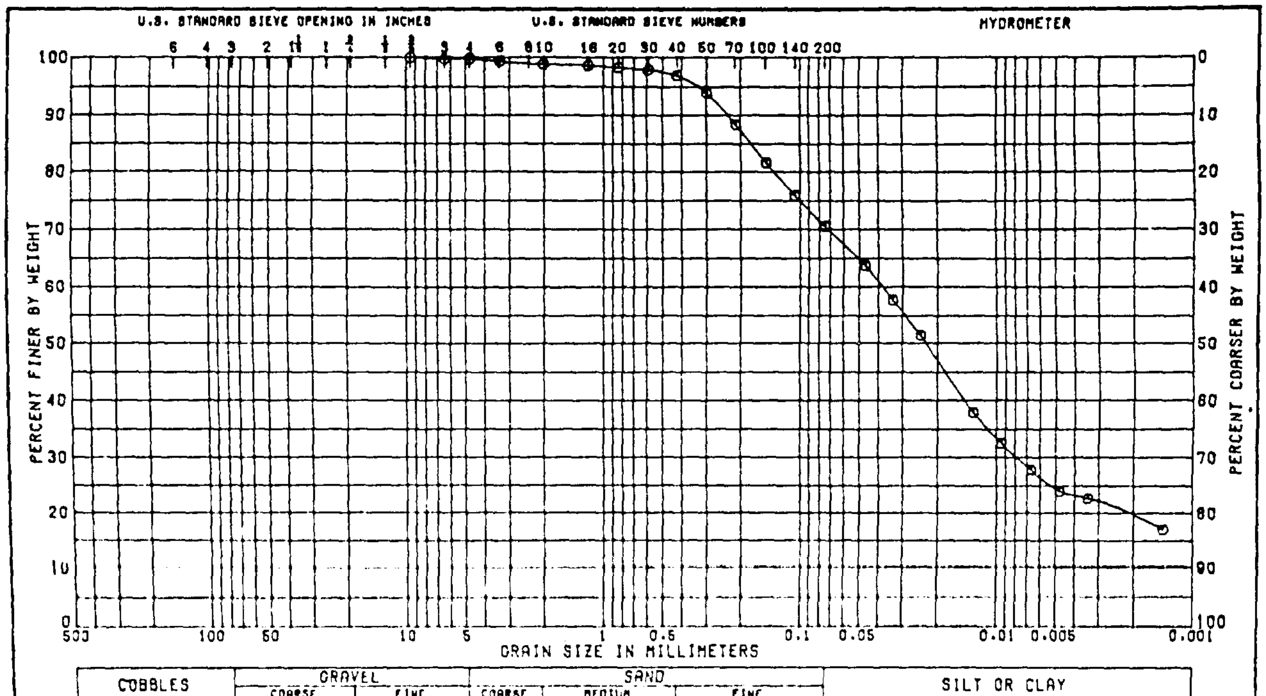
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO
M, FIELD

BORING NO. 8-15-83 SAMPLE NO. APO-1

DEPTH/ELEV SURFACE DATE 07 NOV 83



LL 26	PL 16	PI 10	GS 2.70	NAT W.%	ORG. CONT. 1.8%

CLASSIFICATION

SANDY CLAY (CL), TAN

GRADATION CURVE

PROJECT DOT II FT. CARSON, CO

BORING NO. 8-15-83 SAMPLE NO. APO-2

DEPTH/ELEV SURFACE DATE 07 NOV 83